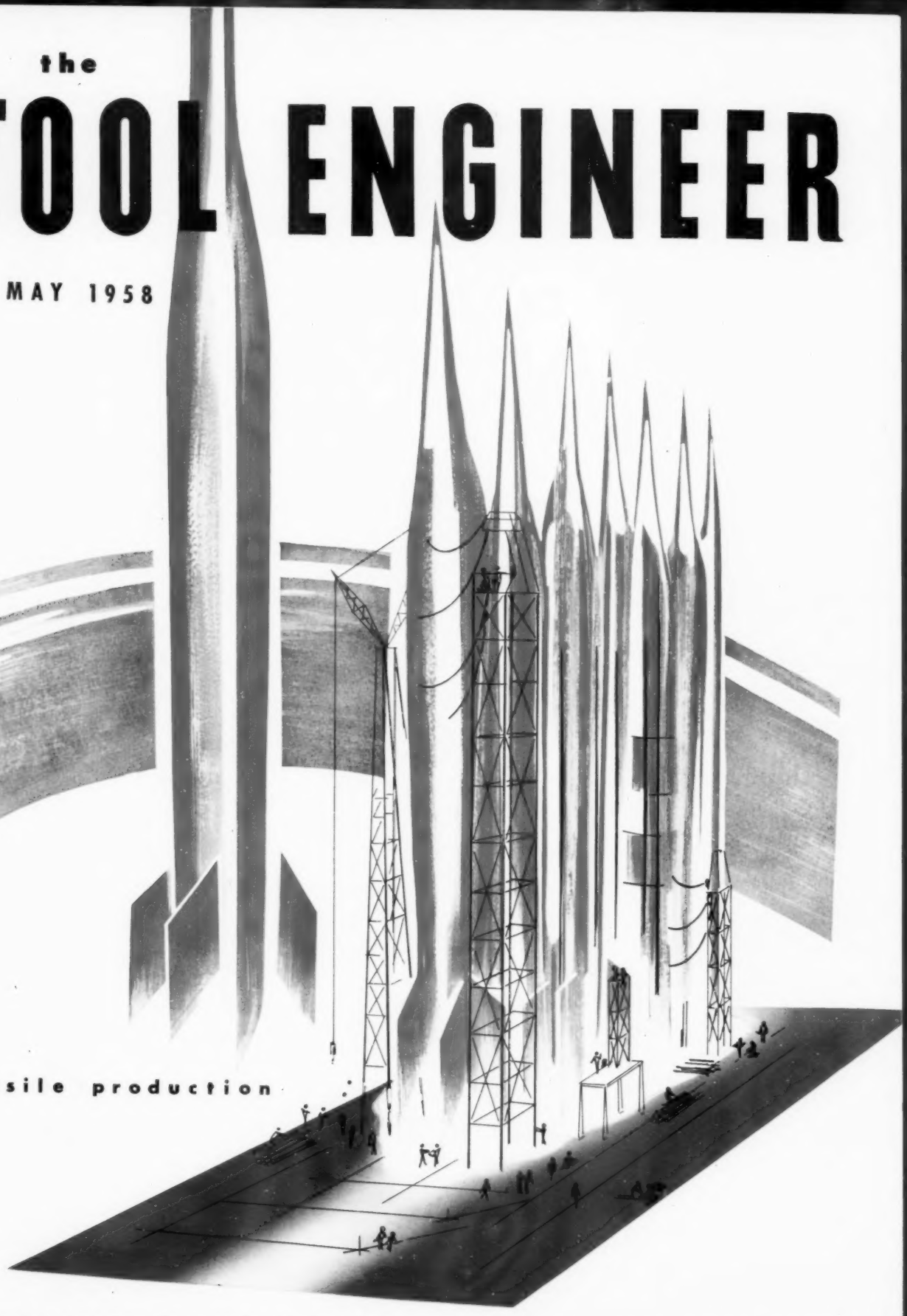
the

TOOL ENGINEER

MAY 1958



missile production

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

it's mainly a matter of TIMING!

The net cost of replacing a machine depends on WHEN you do it

THERE'S A TIME to buy and a time to sell. A time to invest and a time to "sit tight." And a time when you *should* replace an old machine with a new one.

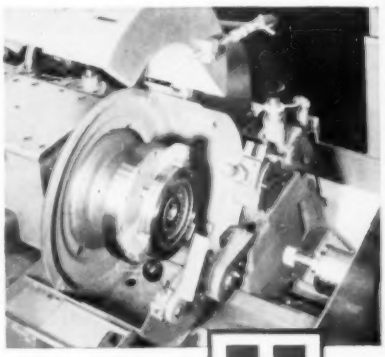
Actually, timing is the most important factor in any replacement program. For there is one precisely predictable time when the replacement of any machine will work out to your best advantage—productionwise and investmentwise. Too soon is just as bad as too late. Either way you *lose money!*

Unless you can afford a loss—and it could be substantial—don't trust intuition or rule-of-thumb computations to determine when a machine should be replaced. There are many variables involved, but they can all be expressed in dollars and cents. And correct timing then becomes a matter of simple arithmetic.

Our sales engineers are well experienced in making obsolescence studies and determining the proper replacement timing. If you'd like some expert assistance in planning your replacement program—or want to confirm your own calculations on a particular machine, just call in your Heald engineer. He will be glad to make a replacement analysis, without obligation of course. Similar studies by Heald engineers have pointed the way to many important savings.

For Example: A large machinery manufacturer was using an old Model 72A Heald Internal to grind the bore and adjacent face of steel countershaft gears. A cost analysis revealed that by replacing this with a new Model 271 Size-Matic, substantial savings could be made. The new machine, shown at the right, was installed with the following results.

	ANNUAL COSTS	
	Old Machine	New Machine
Direct Labor	$13,299.00	$ 5,079.00
Power Consumption	427.00	182.00
Property Taxes & Insurance	45.00	552.00
Normal Maintenance	841.00	500.00
Restorative Repairs, Old Mach.	4,066.00	....
Capital Investment, New Mach.	.....	6,256.00
Total Cost Per Year	$18,678.00	$12,569.00
Annual Saving, New Machine.....		**$ 6,109.00**



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the tool engineer

Vol. 40, No. 5 May 1958

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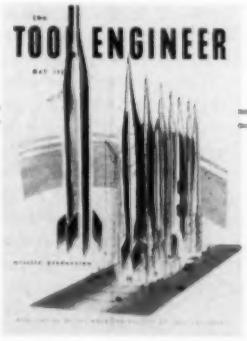
THIS MONTH'S COVER

Missiles and space satellites have captured the public imagination. To tool engineers, they represent a real challenge. How engineers at Chrysler Corp. met this challenge is described in an article beginning on page 81.



THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Industrial Arts Index*.

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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Brake Die saves shop time in forming overlap for steel spout

The problem sounded simple enough — putting an overlap in a section of 20-gage stainless steel, which was then formed into a spout for use in meat-packaging tables. But getting a tool steel which could do the job more economically than the grade formerly used was somewhat of a challenge for the manufacturer, J. B. Dove & Sons, Inc., Philadelphia.

The answer was Bethlehem Brake Die, supplied by our local tool steel distributor, Hill-Chase & Co. Because of Brake Die's easy machinability and good wear-resistance, the new die minimized manufacturing costs. It also helped in producing a better-looking product. Said one of the Dove engineers: "We like Brake Die. It's doing a good job for us."

Brake Die, a special alloy steel, is oil-quenched and tempered to develop a fine balance of mechanical properties. It's ideal where wear-resistance, toughness, resistance to impact and good machinability are required.

Typical Analysis

Carbon 0.50	Manganese 0.90
Chromium 1.00	Molybdenum 0.20

Chances are there might be one or more applications in your shop right now where Brake Die steel could be used to good advantage. Why not talk it over with your Bethlehem tool steel distributor?

BETHLEHEM TOOL STEEL ENGINEER SAYS:

How to Shrink-Fit Tool Inserts

Shrink-fitting of tool steel inserts is a procedure which is being widely used to improve the service life of tools. Shrink-fitting is most applicable to rings and cylinders, such as are used in heading and drawing operations where the tools can be shrink-fitted into large retaining rings. The shrink-fit sets up radial compressive stress in the tool, which is available to oppose radial tensile stress set up in service, and thereby improves the performance as compared to solid tools which are not pre-stressed. Shrink-fitting of tools should be carried out as follows:

1. The retainer must be of adequate diameter and strength to provide the stresses required on the tool insert. This generally means that an alloy steel capable of hardening to approximately 300/400 BHN must be used. Shock-resisting tool steels heat treated to approximately Rockwell C 48 to 52 are used on heavy duty applications. It is recommended that the OD of the retainer be a minimum of twice the ID (preferably three times the ID).

2. A shrink-fit allowance of .003/.004 in. per in. should be provided for. This means that the OD of the insert is .003/.004 in. per in. larger than the ID of the retainer into which it must fit. These dimensions must be carefully maintained in order to obtain the benefits of shrink-fitting.

3. The OD of the insert and the ID of the retainer should have a smooth finish, preferably produced by grinding.

4. The retainer should be heated to a temperature sufficient to cause the expansion necessary to assemble the insert. Care should be exercised not to exceed the tempering temperature used in heat-treating the retainer. If necessary, the insert may be sub-zero cooled to aid in providing the clearance required for assembly.

5. After assembly of the parts, cooling of the assembly should be rapid enough to prevent over-tempering of the insert by heat transferred from the retainer.

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Trained Technicians—A Basic Need

Speaking off the cuff to a group of associates recently, the manufacturing vice president of one of the nation's largest companies made the statement "You can't change a tire with a pencil."

The point he was illustrating is that so far as industry is concerned, a supply of scientists and trained engineers is not enough. Scientists and engineers can develop new and improved production methods and plan production lines but they cannot—by themselves—build those lines or keep them going. That is the function of the trained technician, who may be a skilled machinist, welder, electrician or any one of dozens of other types of specialist.

Scientists and engineers are, after all, the "glamor boys" of industry. Without discounting the present shortage of scientists and engineers in some fields, we think that in the long run there will be an adequate supply. There are ample incentives for students to choose this type of work as a vocation, and, with the present emphasis on the need for better and enlarged school facilities, colleges and universities should be able to handle the professional education of greater numbers of scientists and engineers in the future.

Unfortunately, there has been no corresponding emphasis on the need for training technicians for industry. Shop and vocational courses are, of course, available in large high schools. Often, however, these courses are not geared to the real needs of industry. Often, busy educators are not able to keep abreast with industry requirements or the latest techniques.

There is also the matter of incentives. In many high schools, emphasis is on preparation for college even though a substantial percentage of students will not attend college. On the academic scale of values, courses in literature and history may outweigh courses in shop practice, machining or drafting in importance.

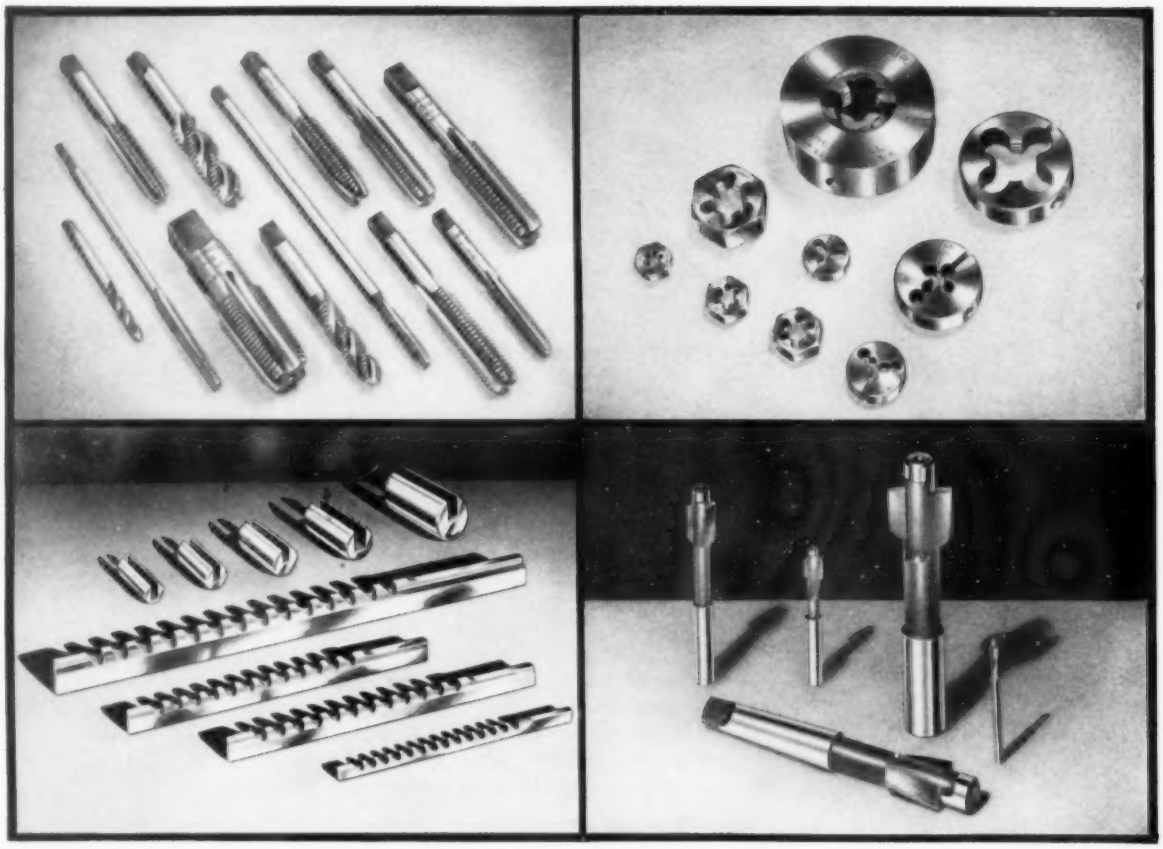
The solution to the problem is, we think, closer cooperation among industry, parents and school administrators. Once the schools know what industry needs, and parents and students become acquainted with the real opportunities and rewards for trained technicians in industry, academic programs will be geared accordingly.

Tool engineers can do much to promote such programs in their own communities. The present and future need is great, for without trained technicians the wheels of industry come to a halt.

Theodore W Black

SENIOR ASSOCIATE EDITOR

THREADWELL CUTTING TOOLS



FOR EVERY APPLICATION

Regardless of application Threadwell has the right cutting tools for the right job. Proof of their superior quality and accuracy is evidenced in their performance. Why not experience the confidence all Threadwell users enjoy and include Threadwell in your production plans . . . now.

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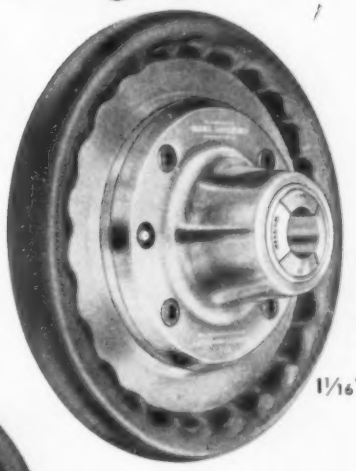
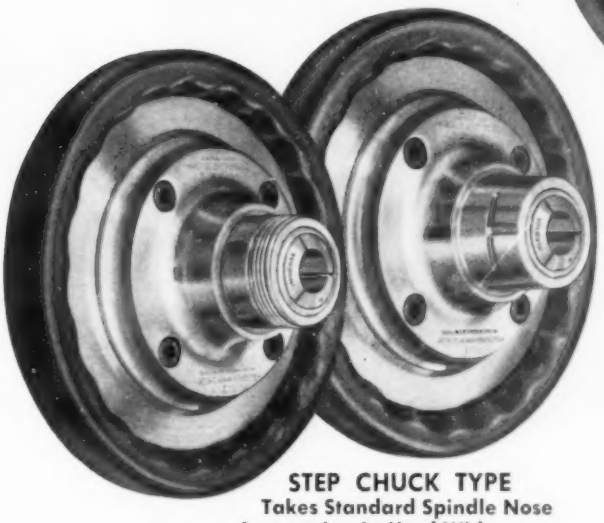


REGULAR TYPE

AVAILABLE IN FIVE COLLET CAPACITY SIZES

1 1/16", 1 3/8", 1 3/4", 2 1/4", 3 1/2"



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Fixed center oil-circulating multiple spindle head with vertical adjustment spindles.

U. S. Drill Heads are designed to provide the fastest drilling speeds that may be required—and to maintain their accuracy over long-run production. Take the Fixed Center Head shown—a close-center, oil-circulating model with full ball bearing design and its own built-in oil pump: this 7-spindle model operates regularly in production at 15,000 rpm with very little heat! Rugged, too! It is built with more reserve stamina than you'll ever need. And as in all U. S. Heads, shaved gears assure quiet, smooth operation—at all speeds.

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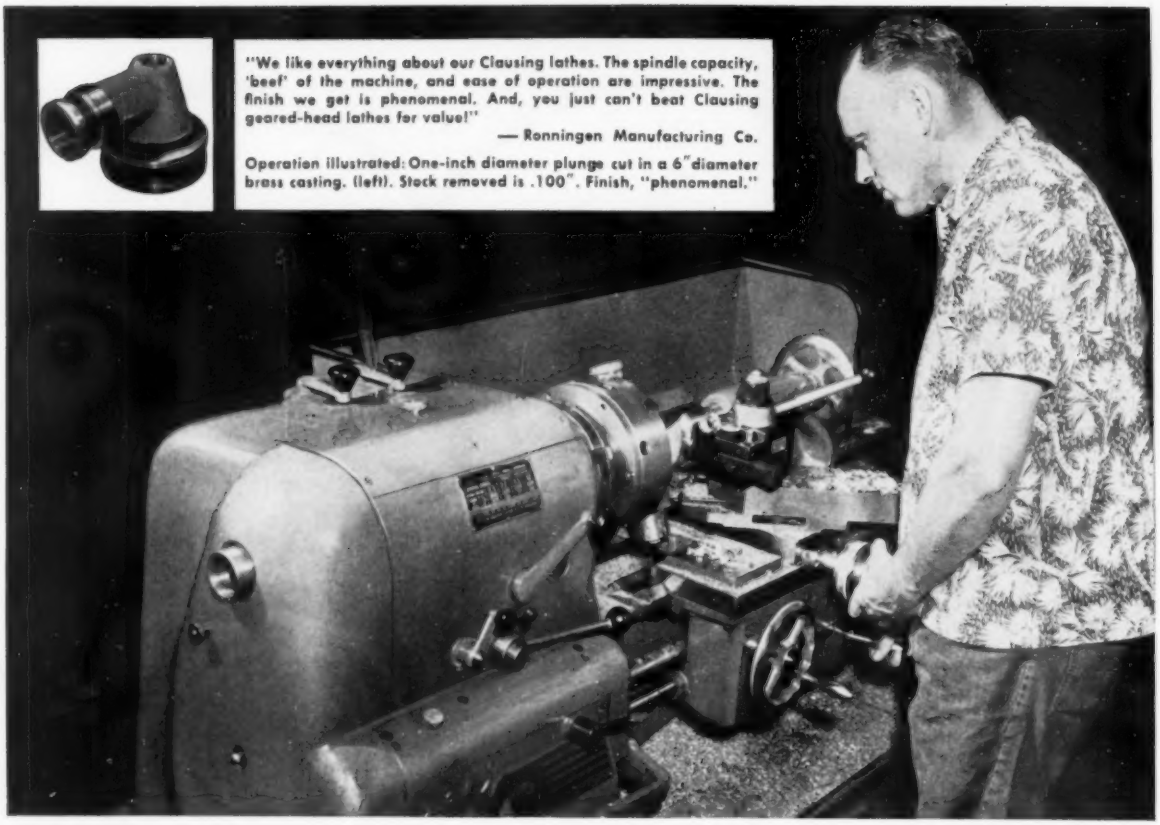

"We like everything about our Clausing lathes. The spindle capacity, 'beef' of the machine, and ease of operation are impressive. The finish we get is phenomenal. And, you just can't beat Clausing geared-head lathes for value!"

— Ronningen Manufacturing Co.

Operation illustrated: One-inch diameter plunge cut in a 6" diameter brass casting. (left). Stock removed is .100". Finish, "phenomenal."

Performance records PROVE CLAUSING (COLCHESTER) LATHES'

Superior Construction . . . Greater Value

The statement of Ronningen Manufacturing Company above is typical — users everywhere report Clausing geared-head lathes lead their field in capacity, performance and value. Here's why:

They're bigger in capacity than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. (See chart at right.) Geared-head drive is powered by one or two speed motor thru multiple V-belts.

Have heavy-duty construction throughout. Beds are 50% steel, 50% iron with elliptical cross ribbing — ways are induction hardened and precision ground. Gears in head and quick-change box run in bath of oil — gear shafts are multi-splined. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile hammered steel forgings — note size. Note, too, the heavy-duty construction of tailstock and double-walled apron.

Built for precision performance — to American standards of toolroom lathe accuracy. Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry. And each Clausing lathe passes rigid tolerance tests before it leaves the factory.

Each is an outstanding value. 13" cabinet base models, including motor and controls, start at $2113; 15" cabinet base at $2988; 17" at $4715. You owe it to yourself to investigate before investing in *any* lathe.

LATHE CAPACITIES

17" lathe: 54" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

SPINDLE CAPACITIES

Lathe	17"	15"	13"
Thru-Hole	3-1/16"	2-1/16"	1-9/16"
Nose Taper Key Drive	L-2	L-1	L-0

BEARINGS

Lathe	17"	15"	13"
Front Spindle Bearing O.D.	7-1/2"	5-1/2"	4"
Rear Spindle Bearing O.D.	6"	4-3/8"	3-9/16"

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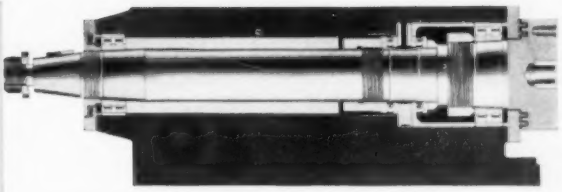
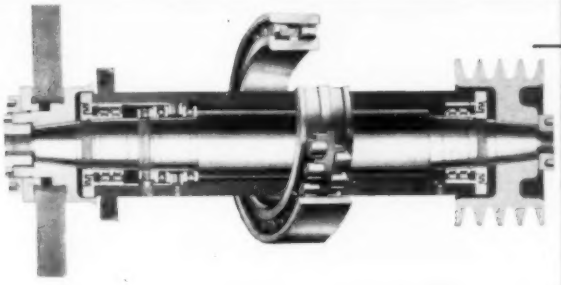
POPE 1, 2 and 3 HP, Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with massive shafts and big, double row cylindrical roller bearings having enormous capacity, superior performance and long life.



FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles for smooth, chatter free, continuous high production of accurate parts. Again, look at the big cylindrical roller bearings and thrust bearings.



FOR CYLINDRICAL GRINDING—

POPE Cartridge Type and Wheel Head Belt Driven Spindles with the capacity to produce more work whether you plunge grind with a crush dressed wheel, remove surplus metal, or produce low microinch surface finishes. Note the super-precision radial bearings and ball thrust bearings.

FOR HEAVY DUTY MILLING—

POPE Spindles have the double row cylindrical roller bearings for the extra rigidity to support the cutting tool, and the double direction thrust bearings with the excess capacity to stabilize the shaft against endwise movement in either direction. This adds up to longer cutting tool life, more production, lower cost per piece.

POPE engineers and builds standard and special, precision anti-friction bearing Spindles for every purpose. Send us your specifications for prompt quotations.

No. 115

Specify **POPE®** PRECISION SPINDLES

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Let's CUT COSTS

on these Secondary Operations

- DRILLING
- REAMING
- TAPPING
- TURNING
- MARKING
- PUNCHING
- GRINDING
- ROUTING
- SAWING
- THREADING

High cost second operations can kill first operation profits. If you perform any of the above secondary operations, better take a critical look at how you do it. There may be cost saving opportunities you've overlooked.

If any one of them involves hand feeding of parts or tools—hand clamping—or mechanical means of performing push, pull or lift motions—The Bellows Co. can save you money.

The Bellows Air Motor and the numerous Bellows packaged pneumatic work units can, in a few minutes, transform hand operated machines and machine tools into fast automatic or semi-automatic production units. They are inexpensive to buy—your own tool room can install them quickly.

Here's how to start—

Write for these two booklets. Bulletin ML-3 and BM-25 will give you a quick picture of what others are doing—of what you can do—in cutting second operation costs. Write Dept. TE558, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

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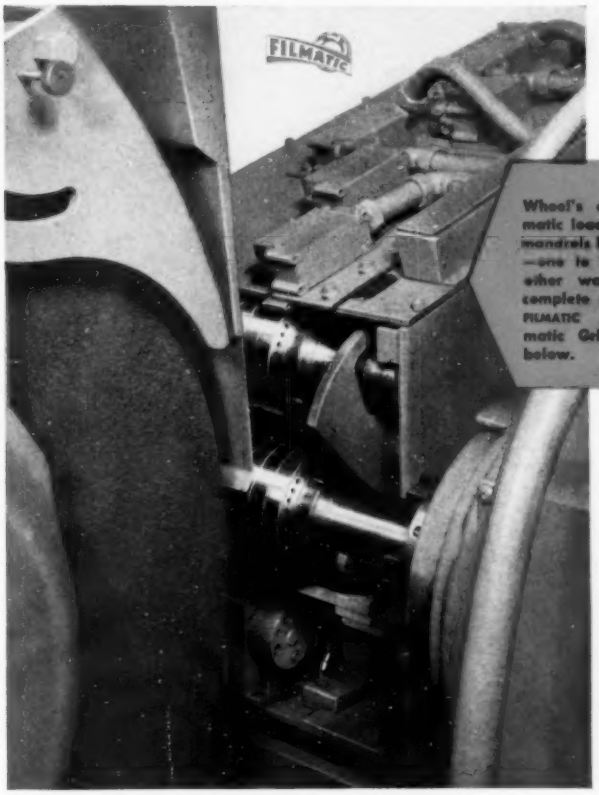
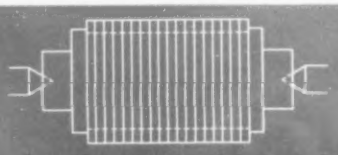
B94-8

Cincinnati Filmatic 14"L Plain Grinder...

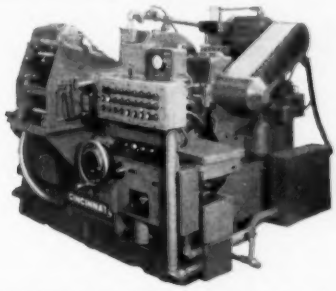
automatically grinds and sizes narrow parts by the dozen



Wheel's eye view of automatic loading fixture and two mandrels holding several parts—one to be ground and another waiting its turn. The complete machine—CINCINNATI FILMATIC 14"L Plain Automatic Grinder—is illustrated below.



8 to 18 parts are loaded on mandrels prior to the automatic grinding operation. Time-study observation, 1.03 min. per mandrel.



CINCINNATI FILMATIC 14"L Plain Hydraulic Grinding Machine, equipped for completely automatic infeed grinding operations.

Production methods dictated a centertype grinder, and good business judgment dictated a CINCINNATI with maximum automation to grind the O.D. of internal gears manufactured in big volume. A CINCINNATI FILMATIC 14"L Plain Grinder, completely equipped for automatic grinding, does a highly profitable, dependable job. Features of low-cost operation include:

- Automatic loading fixture
- Automatic grinding cycle
- Automatic air-electric gage sizing, with Cincinnati's exclusive cycle time stabilizer
- Automatic behind-the-wheel truing, incorporating cycle counter
- Automatic grinding wheel reciprocation, interlocked with the truing cycle
- Gap eliminator (reduces "cutting air" portion of infeed cycle)
- Hydraulic footstock

FILMATIC grinding wheel spindle bearings, automatic wheel balancing and other standard features and construction characteristics tie the foregoing automation elements together to form a dependable, high production, controlled accuracy grinding machine. ¶ This precision centertype grinder is typical of the fine engineering developed by Cincinnati's Automation and Engineering Service Specialists. These men are ready to give you the benefit of their experience in six distinct types of precision grinding: centertype, centerless, chucking, Micro-Centric, centerless lapping, roll. Make Cincinnati your headquarters for fine grinding machines built to your requirements. Metalworking plants throughout the world have found it profitable to do so.

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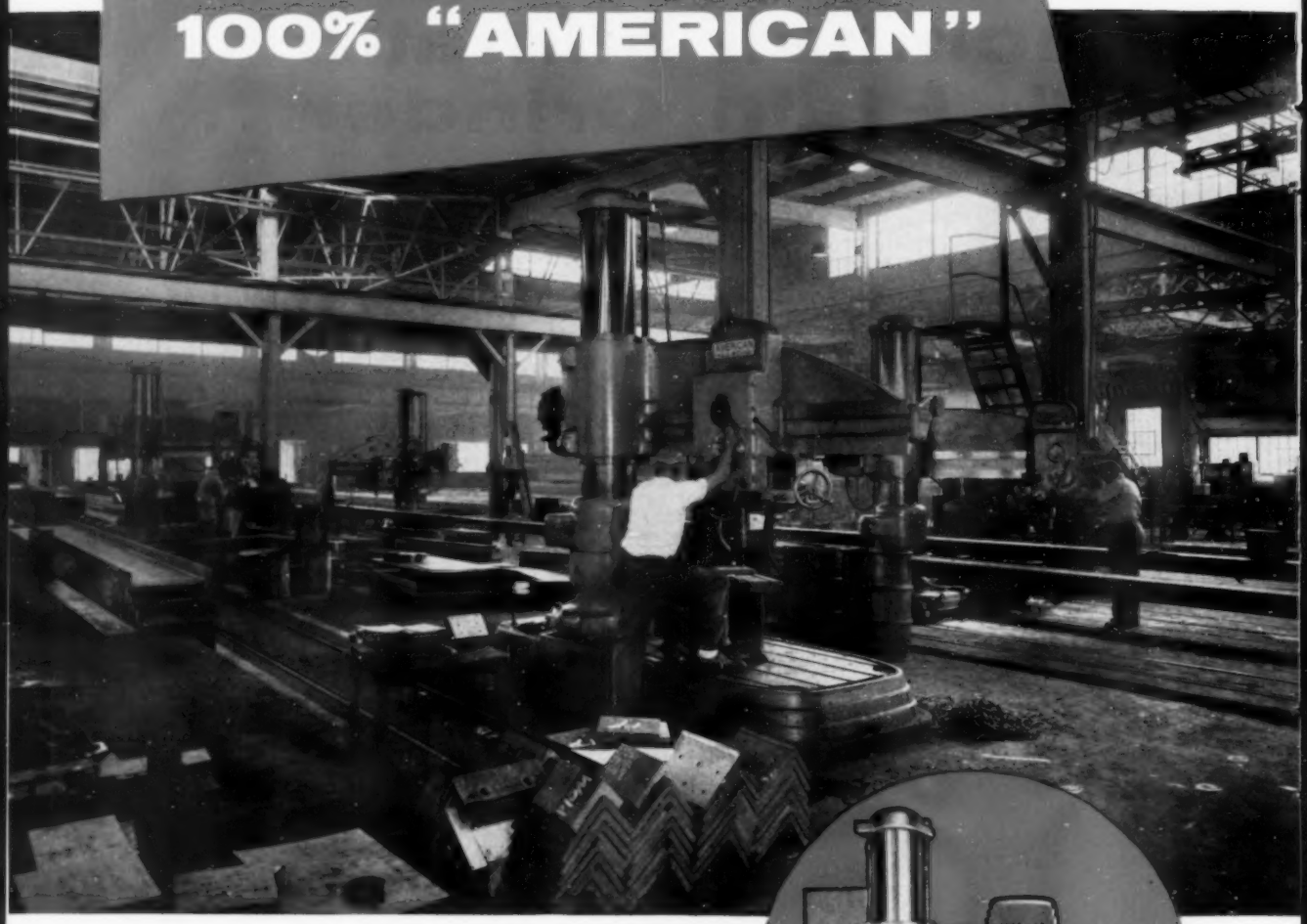


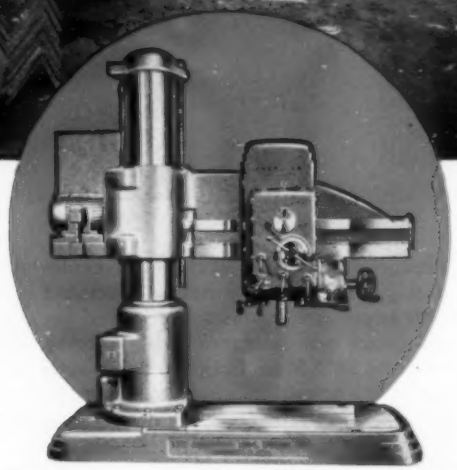
The Stupp Bros. Bridge and Iron Company of St. Louis, Missouri, known the country over as one of the leading structural steel fabricators, use "AMERICAN" Radial Drills exclusively.

Mr. Erwin P. Stupp, President, gives as his reasons for his continuous selection of "AMERICAN"—

- EASE OF HANDLING
- RIGIDITY
- FAST MANIPULATION
- LOW MAINTENANCE

These factors combined with the extra power offered by "AMERICAN" Hole Wizard Radials guarantee a handsome return upon the user's investment.

The half dozen "AMERICAN" Radials installed during the past 10 years are conclusive testimony to the satisfactory service afforded by these modern drilling, boring and tapping machines.



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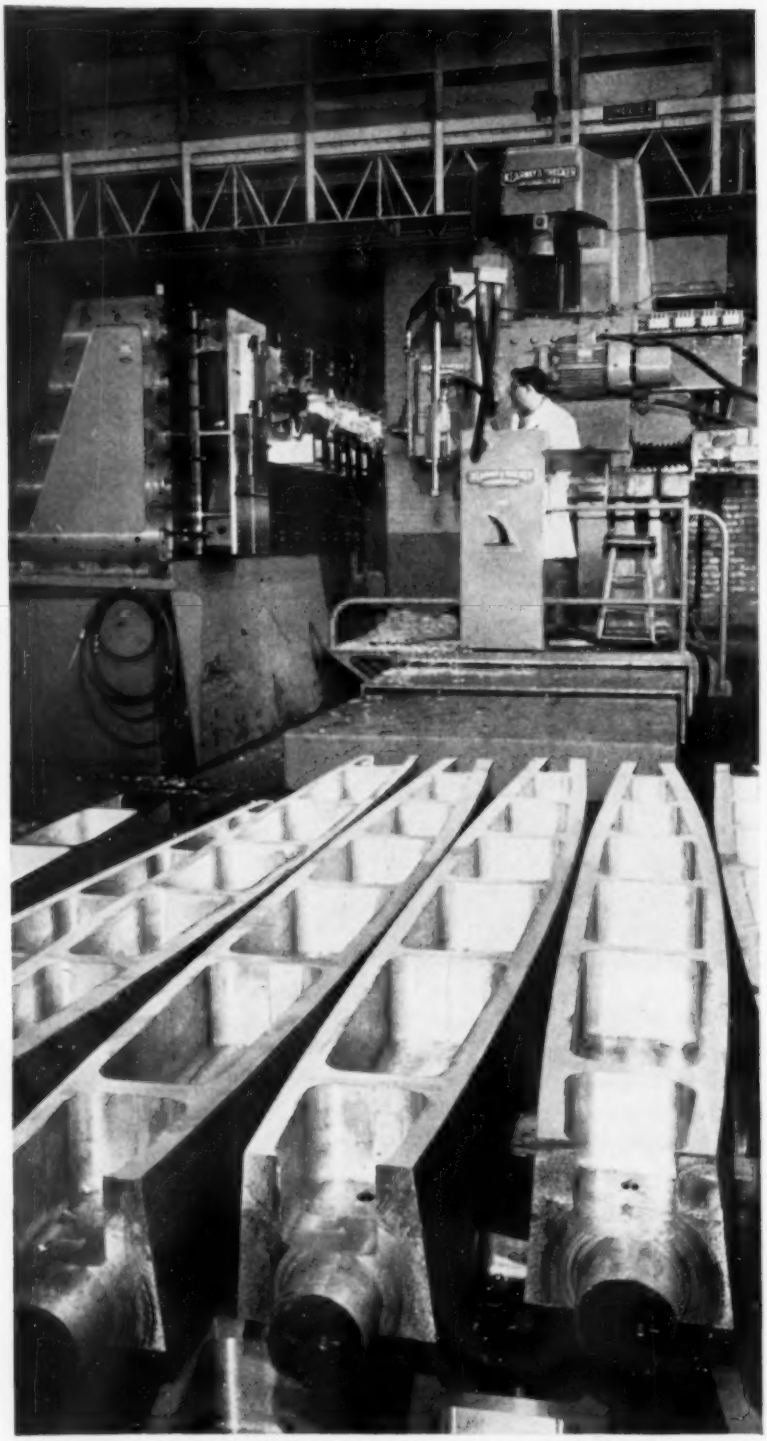


Wing root attach ribs of the USAF—Northrop Snark intercontinental guided missile, produced on a Kearney & Trecker milling machine operating with a Bendix Tape Control System.

Numerical control unit eliminates templates, cams and models— cuts production time 65%

A remarkable milestone in metalworking progress has been achieved with the development of the Bendix* Tape Control System for machine tools. Twenty-two of these time-slashing systems are already in operation in major aircraft and forging plants, and many more are on order. Possibilities for use in the automotive and appliance industries, as well as in job shops, are virtually limitless.

The Bendix TCS uses coded punched tape to control all machine motions. It provides a precise, versatile method of automating machine tool cutting functions. It slashes metalworking production costs.

Working almost directly from a blueprint, a Bendix TCS set-up can often turn out parts in a matter of hours. One aircraft company reported production time on a tooling fixture reduced from 500 hrs. to 9 hrs.

Another example: An intricate key part for a jet engine once required a skilled workman's entire working time for ten weeks, turning out a master part for production to copy. The Bendix Tape Control System does the same job in two days.

Tremendous production lead time savings are made possible since no templates, cams, models or complex fixtures are required. Reductions in tool cost often top 80 percent.

Built-in quality control devices, in

NEW BENDIX TAPE CONTROL SYSTEM REVOLUTIONIZES MACHINE TOOL OPERATIONS

the form of automatic error-detecting circuits and continuous digital feedback controls, automatically shut down the machine if any malfunction is detected—or adjust motions if errors occur. Excellent surface finishes are achieved with the system because the cutting tool moves in a smooth, calculated, continuous path at all times.

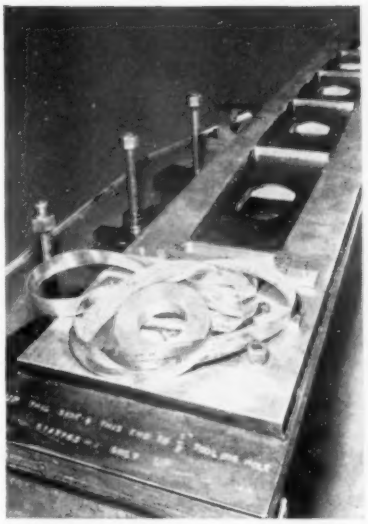
FLEXIBILITY MAKES SYSTEM PRACTICAL

The system is extremely flexible. The machine tool operator can manually override the machine feeds within a range of from 20 to 100 percent of the programed feed rates. Either "continuous-position readout" or "inching" controls can be provided. The Bendix System allows the operator to stop the machine, withdraw the cutter spindle, change the tool, return to machining position and continue under tape control *without loss of synchronization.*

Bendix Tape Control can be adapted to a wide variety of milling, turning, jig boring and drilling machines. It is ideally suited to the machining of intricate three-dimensional parts containing pockets, flanges, tapers, contours or grooves.

With a machine tool of the single-tool milling or contouring type, TCS ensures an extremely versatile operation for short-run production of a wide variety of parts. Change from one part to another is a matter of minutes. Bendix Tape Control is thus ideal for machines in tool and die plants.

The Bendix System uses a simple punched plastic-coated metallic tape that is rugged and durable. The tape is quick and easy to prepare with a minimum of equipment and skilled personnel. (In one instance, a part requiring 40 hrs. of machining needed only 450 feet of tape.) Punched tape, which can be visually interpreted, is easily modified to accommodate engineering changes.



The tape shown here replaced the massive template on which it lies in producing the Snark wing root attach ribs.

EASILY INTEGRATED INTO PRODUCTION FACILITIES

Designed for simple maintenance and minimum of down-time, the Bendix Tape Control System can be easily integrated into existing planning and production departments of metal-working plants. Tool engineering departments can assimilate the tool drawing, process sheet and tape preparation functions. The compact cabinet housing the machine control can be easily installed adjacent to the machine tool to be controlled.

Bendix TCS units, installed on Kearney & Trecker milling machines, are now being used by key aircraft and missile contractors and subcontractors, including Martin, Boeing, Lockheed, Northrop, Republic, Bell, Avco-Lycoming, Wyman-Gordon, and Harvey.

If you're looking for ways to speed production and cut tooling costs in your machine tool operation, we'd like to tell you more about Bendix Tape Control. For a brochure, write to Controls Section, Bendix Aviation Corporation, Dept. B, 21820 Wyoming, Detroit 37, Michigan.

*TRADEMARK

How Bendix Tape Control slashed lead and production time on the Northrop Snark wing root attach rib

Tooling	Tape	Pattern
Tool Weight	16 oz.	480 lbs.
Loft Template	None Required	40 hours
Make Time	7½ hours	250 hours
Planning	144 hours	110 hours
Total	151.5 hours	400 hours

Savings—248.5 hours

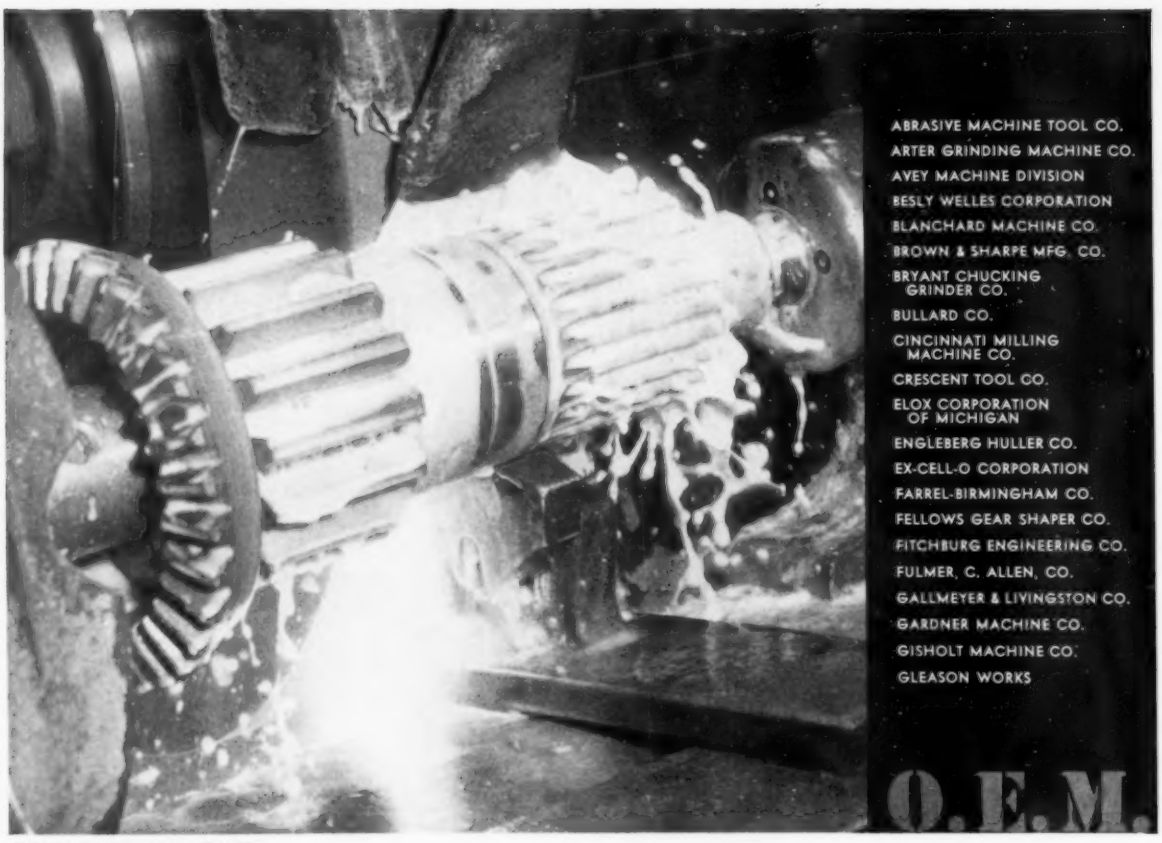
Machining	Tape		Tracer
1st rough operation	1.33 hours		4 hours
2nd rough operation	1.33 hours		4 hours
3rd finish	2.50 hours		7.3 hours
Handling	.66 hours		1.0 hours
	5.82 hours	vs.	16.3 hours

Savings—10.48 hours

Be sure to visit our exhibit at the ASTE Tool Show, Philadelphia, May 1 to May 8, 1958. See a complete TCS-equipped machine tool in operation, Booth 936.

Controls Section

Bendix
AVIATION CORPORATION



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MASTERLINE GISHOLT SINCE 1887

ALLOY PRODUCTS MACHINES STAINLESS PARTS 25% FASTER

Uses JETracer and smart tooling to improve quality, increase output

Machining tough stainless steel? Having problems avoiding distortion, obtaining smooth finish and long tool life? Then this 4L Saddle Type Turret Lathe setup at Alloy Products Companies, Sanford, Maine, plant will interest you.

The workpiece, a rear bearing support, is handled in four operations alternated between opposing faces to minimize distortion. A JETracer or a bridge-type cross slide handles contour machining. A special cam on a cross-feeding hex turret taper attachment is used on the difficult bore. Longitudinal feed dials and precision dial indicators on the hex turret and cross slide speed longitudinal and cross positioning. For the third and fourth operations, fixtures are mounted on the chuck face instead of the spindle nose to reduce change-over time.

Here is a brief summary of the four-operation sequence:

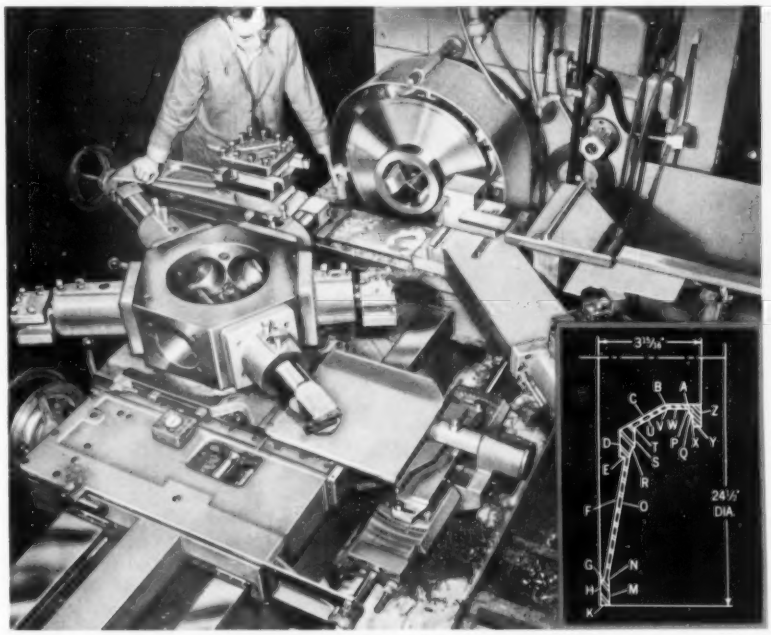
Operation 1—centralize and hold in bore A locating at H in 28″, three-jaw scroll chuck. Tool post tools rough surfaces M-S-W-K. Most of these cuts are made while hex turret tools are used to rough surfaces Y-Z-U. Contoured surfaces M-N-O-R-S-T-U-V are roughed by the JETracer. Time—60 minutes f.t.f.

Operation 2—using same chuck with new jaws, centralize and hold on diameter K locating at S. Tool post tools rough surfaces H-E. Again, these cuts are combined with hex turret tooling wherever possible, as surface D is rough-faced and A-B-C is rough-bored using the special cam guide plate on the cross-feeding turret taper attachment. The JETracer rough-faces H-G-F-E to complete the operation in 65 minutes, f.t.f.

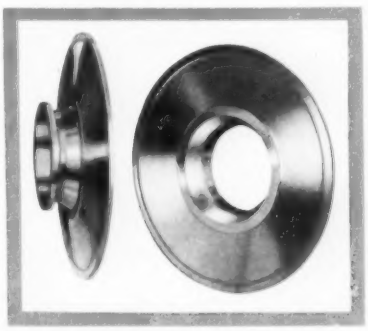
Operation 3—work is centralized and held at A using a hand-operated expanding mandrel and supporting rings at F-D. Tool post tools face Q-P, hand-feeding to depth at P, using the dial indicator. Surfaces M-N-O-R-S-T-U-V are finish-traced while Z is faced from the hex turret. W is turned, blending with V, and Y is turned from the hex turret. Tool post tools chamfer X and remove burrs from Y-Z to finish one side of the part in 35 minutes f.t.f.

Operation 4—work is centralized and held at Y, locating at S, using a hand-operated collet fixture with supporting rings at O-M. A-B-C is finished using the taper attachment. D is also finished from the hex turret. K is turned from the tool post and H-G-F-E is finish-traced. Time is 35 minutes, f.t.f.

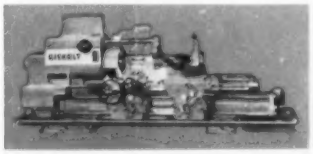
JETracer assures complete accuracy and smooth finish on all surfaces. Combined cuts and simple accessories speed machining, reduce operator fatigue. Alternating operations between work faces eliminate part distortion.



Work and tooling for first operation. Note dial indicator on cross-feeding hexagon turret for fast cross-wise positioning, and special cam guide plate on taper attachment for accurate machining of the bore.



Close-up of workpieces showing surfaces machined in the four operations. Note difficult contours and blends finished to blueprint tolerances using the JETracer and the special cam on the taper attachment.



THIS SETUP CUTS 1.5 MINUTES FROM 5-MINUTE JOB

Automatic cycle control speeds operation; octagon turret simplifies tooling

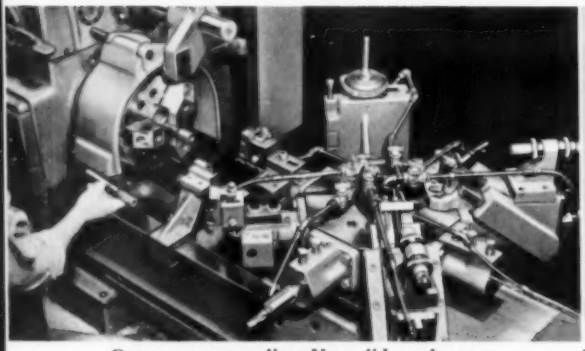
Here's how a well-known manufacturer cut machining time 30% on ⅞"-diameter steel tool holders. The machine, a No. 3 MASTERLINE Ram Type Turret Lathe, has a hydraulic drive unit to control octagon turret tools, provide automatic spindle speed and feed selection, automatic start-stop-reverse of the spindle and reverse feed, when required, to clean up a cut or clear turning or recessing tools.

The previously machined tapered shank of the ⅞" holder mates with a centralizing ring and locates against a spring-loaded stop within a 10", three-jaw air chuck. Tools on all eight turret stations are used to drill, turn, face, chamfer and machine three internal recesses.

Two different methods are used to generate the recesses. Slide tools on two stations are actuated by engagement of a roller with a positive stop on the overhead pilot. A third slide tool is controlled by a tapered cam mounted on a bracket across the bedways, near the spindle. In each case, continued longitudinal feed of the turret ram forces the tool-carrying slide to move vertically, engaging the tool for the recessing cut. Reverse feed is used to clean up the cuts and clear the tools. Time is only 3.5 minutes f.t.f.

A variety of holders, ranging from ¼" to 1¾" diameter, are handled with the same basic setup. Simple jaw inserts speed change-over. Rigid tooling easily holds runout within .0015" for the length of the bore.

Smooth, positive hydraulic drive provides fine finish, maximum tool life, using proper speeds and feeds on all surfaces. Automatic cycle lets operator run another machine for extra savings.



Octagon turret tooling. Note slide tools, at right, operated by stop on overhead pilot. Also, tapered cam on bracket near spindle, used to actuate third slide tool.

⅞" steel tool holders. Left to right: rough part; part showing O.D. machining; sectioned part showing internal machining.

HOW AMERICAN BLOWER ASSURES PRECISION BALANCING ON FAN ROTORS

Handles variety of rotors from 350 to 10,000 pounds, with one machine

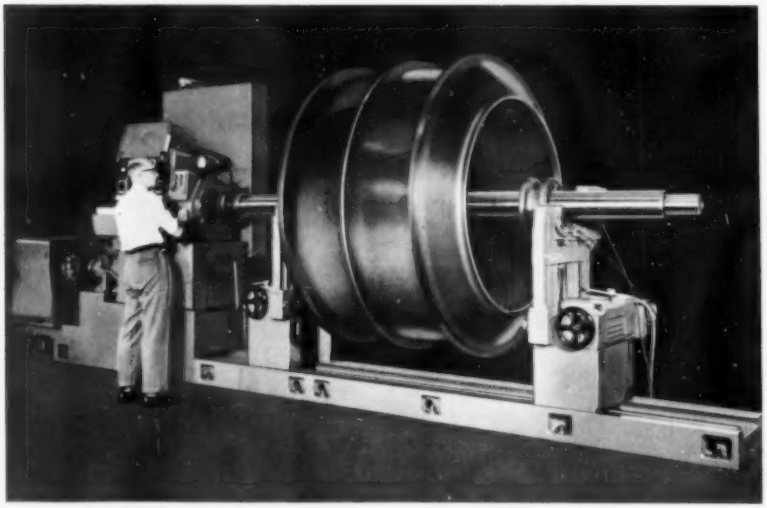
You'll be impressed with the job this 6U Balancer is doing for American Blower Division of American Radiator and Standard Sanitary Corporation at their Detroit, Michigan, plant.

To handle the large variety of parts, the 6U is arranged to handle workpieces up to 10,000 pounds, 98" diameter, 120" long and 14" maximum bearing diameter. Because of the weights involved, the work-supporting bearings have independently controlled pressure lubrication. An American Blower adjustable speed Gyrol Fluid Drive, driven by a 30 h.p. motor, permits balancing rotors from 350 to 1500 pounds at 300 r.p.m., and from 1500 to 10,000 pounds at 150 r.p.m.

Work includes special high-speed wheels, double- and single-inlet wheels, compressor and fluid drive rotors. The balancer may be set up to locate and measure either or both single- and two-plane unbalance, depending on the part. The amount meter accurately measures bearing movements of .000025 at 300 r.p.m.

This setup on a double-inlet wheel is typical. The wheel and shaft weigh approximately 5600 pounds, and require only 30 seconds to accelerate to balancing speed and 30 seconds to stop. The operator measures and locates unbalance in each of the two correction planes in less than five minutes. Correction is made by welding at the indicated angles, leaving the part in the machine. To check for balance, the part is then rotated again.

Despite heavy workpieces and the large size of the machine, the 6U needs no special foundation for accurate operation. Electrical networks improve accuracy over former methods, and speed measurement and location of large amounts of unbalance.



Gisholt 6U balancing double-inlet wheel weighing about 3800 pounds with an 1800-pound shaft. Wheel is balanced within bearing movement of .0003 displacement or .0006 total bearing vibration at 150 r.p.m. Note American Blower Gyrol Fluid Drive at left end of machine.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

BOWER ROLLER BEARING CONES MACHINED 25% FASTER

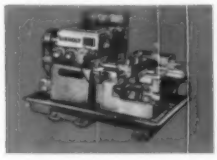
4-pass JETracer, auxiliary slide combine cuts, speed operation

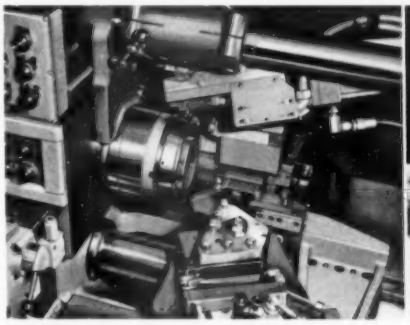
Check this setup closely—it shows how Bower Roller Bearing Div. of Federal-Mogul-Bower Bearings, Inc., Detroit, Michigan, uses one basic set-up to cut time an average of 25% on more than ten different sizes of 4320 steel bearing cone forgings.

A standard MASTERLINE No. 12 Automatic Production Lathe is used. Special tooling includes a JETracer unit on the front slide having a four-position indexing template holder permitting one to four passes at the work during the automatic cycle. The tracing tools are held in a two-position tool holder that presents a roughing or a finishing tool to the work as required. Angular facing and grooving are handled from an overhead auxiliary slide, adjustable within a range of 15° to 90° from the spindle centerline to handle the wide range of parts.

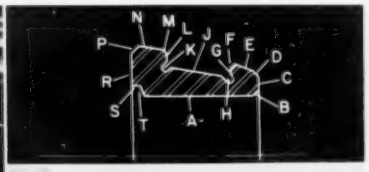
Here's the machining sequence on an 8½"-diameter, 1⅞"-wide bearing cone. Surfaces A-T-S-R-P-N have been previously machined. An air-operated expanding mandrel holds in bore A locating at R. First, the JETracer roughs E-J-L. On the second pass, the same surfaces are semi-finished and rear independent slide tools face C and form relief H. The two-position tool holder indexes the finish tool to the work for the third pass and surfaces D-E-F-G-J-L-M are finished. Feed continues until a tool on an adjustable holder on the longitudinal feed bar forms B. The overhead auxiliary slide then forms K and finishes angular face L. Total f.t.f. time is just 2.70 minutes.

Two-speed motor provides proper surface speeds during turning and forming cuts. Four-pass JETracer permits multiple passes at the work for greater accuracy and longer tool life. Expensive form tools, previously used, are eliminated.





Workpiece on expanding mandrel, with circular recess tool on overhead slide ready to form recess K and shave angular face L. Note indexing tool holder carrying rough and finish tools.



Before and after workpieces showing stock removed (⅜" to ¼" on a side, more at flange and relief sections) and surfaces machined.

THE WM. POWELL CO. CUTS MACHINING COST 30%

"Reverse" tooling lowers cost, ups production of plug valve bodies

Here's a special tooling setup that's paying big dividends in lower costs and increased production for The Wm. Powell Co., valve manufacturer in Cincinnati, Ohio. The machine, a Simplimatic, is equipped with a special valve body clamping fixture mounted on a screw-fed platen table, an air-operated loader mounted on the headstock, and a special cam-operated facing head mounted on the spindle.

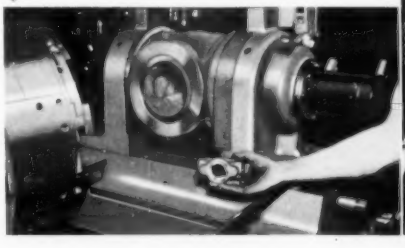
Workpieces are placed on a spring-loaded tapered plug, on the loader A. The platen table is moved to the load position and pusher bar B forces the work onto the tapered plug, locating and centralizing in the bore. One side of the clamping carriage is fixed to locate the work on center and the other side grips for machining. The platen table retracts so the loader can move up, out of the way. Then, it moves forward to machining position and locks in place. Tools on the facing head move out from center to rough and finish the outer face, rough- and finish-face the co-bore and finish-size the co-bore diameter. The tools then return to starting position and the table retracts. The operator inserts a hook in the tapered bore and the clamping fixture releases for unloading. Floor-to-floor time on the 6" plug valve body shown is only four minutes.

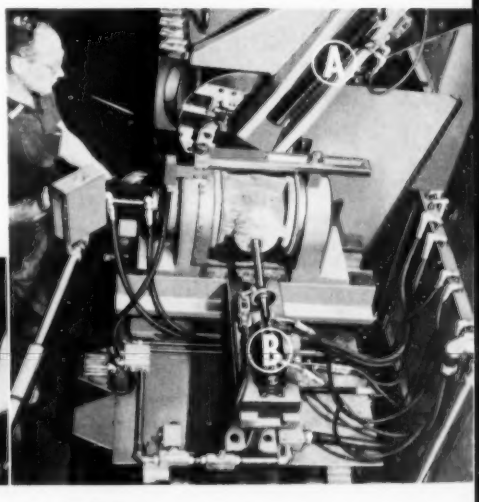
Twenty different plug valve bodies are handled in this manner. Sizes range from ¾" to 6" and average lots run 1000 pieces or less. Setup is fast because only the tools, the clamping carriage, the tapered plug and the machine stops need be changed or adjusted.

"Reverse" tooling eliminates expensive spindle-mounted fixtures, problems of fixture balance, and assures rigidity for accurate machining. Loader simplifies and speeds work handling.

Loader A supports workpiece as pusher rod B locates and centralizes on tapered plug for clamping in fixture. Note extended push-button control panel permitting operator to observe and control operation from one position.

Largest and smallest plug valve bodies are handled with this setup.





MASTERLINE GISHOLT SINCE 1887

HOW HARNISCHFEGER SAVES 5 MINUTES ON CLUTCH PART

2-speed motor, rigid cross-slide tooling simplify forming operation

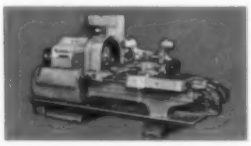
This job-story is especially for those producing parts requiring heavy forming or grooving operations in addition to standard turning, facing and boring.

The part is a tough steel male-clutch forging, hardened to 255-285 Brinell. It's machined in two operations on a MASTERLINE 2F Fastermatic Automatic Turret Lathe at Harnischfeger Corporation's Milwaukee plant.

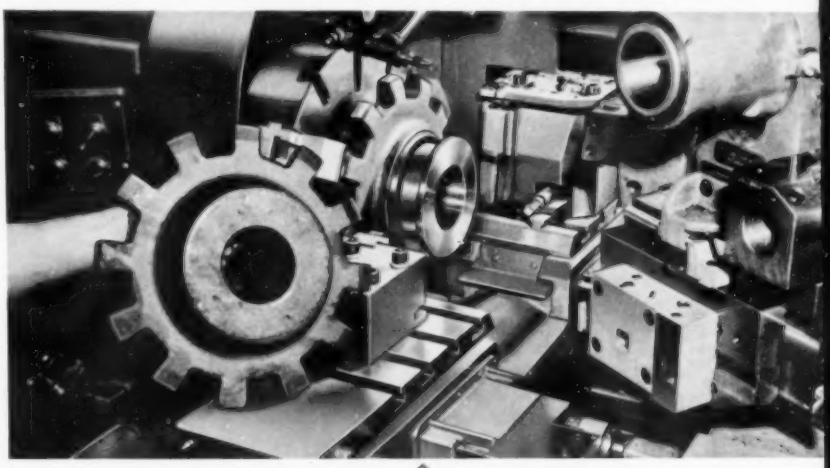
For the first operation, an 18", three-jaw air chuck holds at X, locates at Y. The hex turret is set at non-index. Forward longitudinal feed turns A. Then the turret holds in place as a turret-facing attachment on the rear cross slide operates a turret-mounted slide tool, facing C-B. F.t.f. time: 2.8 minutes.

For the second operation the same chuck is used, and the work is held on A, located against B. Hex turret tools turn F, face E and rough- and finish-bore D. Front cross-slide tooling roughs and rear cross-slide tooling finishes the deep groove G, using the low side of the two-speed motor to assure maximum tool life and a fine finish. F.t.f. time: just 8.5 minutes.

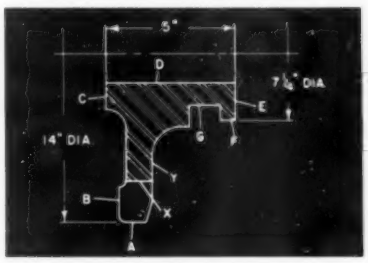
The same machine handles a variety of parts, including several sizes of sheaves, rollers and jaw clutches.



Fastermatic's smooth, hydraulic feed against positive stops assures repeat-accuracy, better finish on all cuts. Time is saved by intelligent use of simple accessories, including two-speed motor, turret-facing attachment and turret-facing slide tool. These also provide added flexibility to handle other parts at no additional cost.



Close-up of work and tooling for second operation. Note: tool block on rear cross slide with massive dovetail form tool used to finish form groove G, and stock removed when compared to rough workpiece in foreground.



GRINDING ELIMINATED WITH THIS SETUP

Manufacturer saves time, cuts costs by Superfinishing from machined surface

Model 81 Superfinisher tooled to Superfinish machined thrust face to eliminate intermediate operations. Chamfering attachment permits completing two operations in one quick 30-second cycle.

Looking for smoother, flatter, longer wearing thrust or seal surfaces? Want to cut costs by eliminating unnecessary intermediate operations? Then you'll want to study this setup at a well-known automatic transmission manufacturer's plant.

The machine is a Gisholt Model 81 Single-Spindle, High-Production Superfinisher. The workpiece is a cast iron automatic transmission front clutch cylinder of 163-207 Brinell hardness. Here's how the parts are handled in one fast operation.

The work is placed in a fixture mounted on the lower, work-rotating spindle. The operator presses the cycle-start button and the upper rotating quill descends, engaging a cup-type stone with the thrust face. The work-holding spindle and the stone-carrying spindle rotate in opposite directions. In just a few seconds stone directions. In just a few seconds stone contact time, the machined surface is reduced to 20 micro-inches RMS. At the same time, a chamfering attachment mounted on the side panel deburrs the splined O.D. edge. Time: only 30 seconds f.t.f.

Superfinishing machined surface saves intermediate operations, provides desired low micro-inch surface finish, exposes true base metal for long service life. This setup permits production of 95 parts per hour at 80% efficiency.

No. 5-658
707

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

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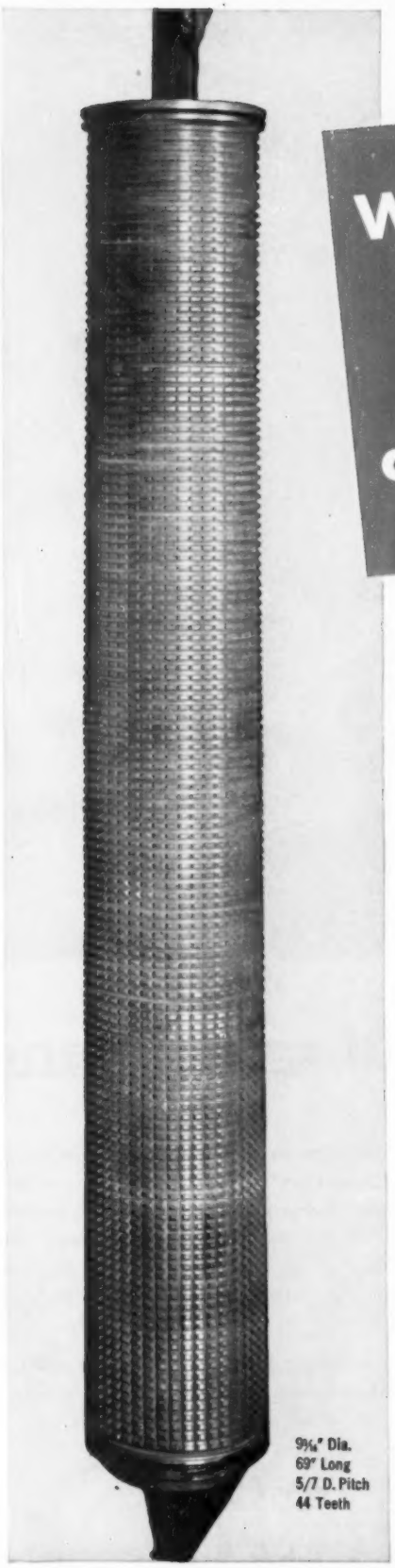


9¾" Dia.
69" Long
5/7 D. Pitch
44 Teeth

Who Would You Trust to HEAT-TREAT a BROACH Like This?

At the time this Red Ring Naloy Broach* reached heat-treat, about $5,000.00 had been spent on it. One mistake during the heat-treat operation could reduce it to scrap. In addition, the resulting delay might seriously disrupt our customer's production schedules.

These are only two of the reasons why Red Ring Broaches are heat-treated in our own plant under control of our own metallurgists. Here we have equipment especially designed and selected for just this type of work. Here we have an organization with a background of know-how that has been building up for the last 30 years.

Complete control over every production operation by men who KNOW broaches, gives the Red Ring Broach that extra precision—that extra service life—that added economy for the user.

***See the cover illustration of American Machinist, November 4 issue.**

7983

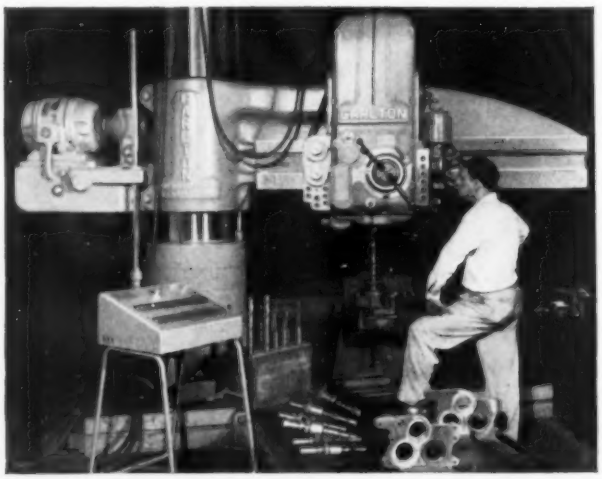
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

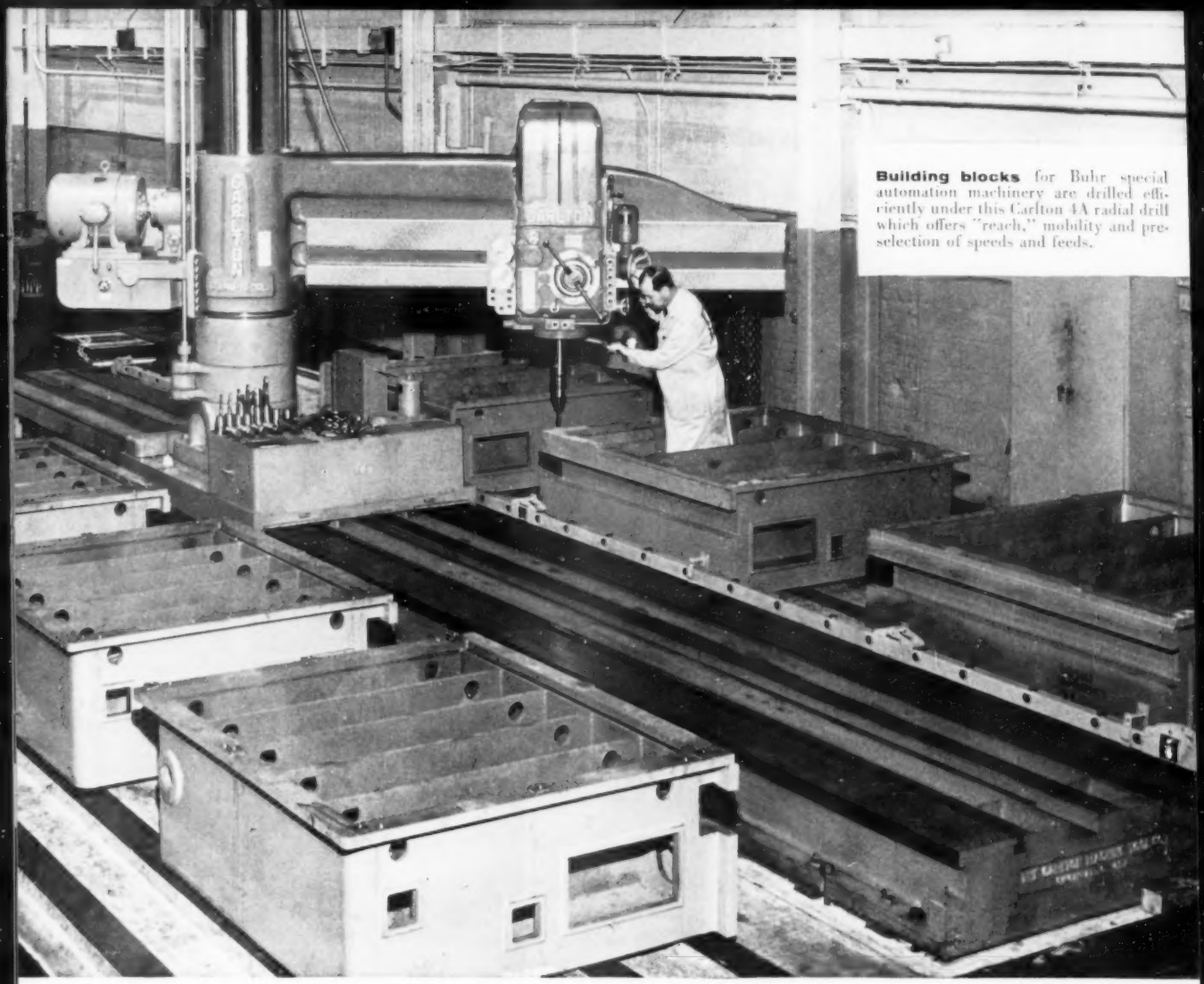
"We like the quality and consistency



"As a manufacturer of special multiple-operation machines, we know how important it is to customers to be able to depend on consistent high quality," says Vern Doneth, plant superintendent, Buhr Machine Tool Co., Ann Arbor. "That's why we're so well pleased with the high quality, day-in-day-out performance of our Carlton radial drill.

"When we bought our Carlton, we had in mind the wide choice of size, speed-feed controls and types

Programmer-pre-selector speed-feed control for Carlton radial drills cuts drilling costs as much as 19%, as determined by extensive 3-month study. Complete report contained in bulletin 110, free upon request.



Building blocks for Buhr special automation machinery are drilled efficiently under this Carlton 4A radial drill which offers "reach," mobility and preselection of speeds and feeds.

we get from Carlton Radial Drills"

of bases. This enabled us to choose exactly the right combination for production drilling and boring of standard components for Buhr 'building block' machines.

"We selected the Carlton 4A with 9-ft. arm which has an effective 'reach' of almost 8-ft. radius. The full speed-feed pre-selector saves valuable time by allowing the operator to set one speed-feed combination ahead. The special sliding bed plate base gives us 30 feet of mobility—more than enough to drill and bore 10 bases at a time."

Carlton engineers will be glad to work with your engineers in laying out the most efficient radial drill set-up for your requirements. For maximum hole drilling and boring production today and tomorrow, check Carlton now. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *specialists in radial drills*

$7200 per month saving by large automotive plant after switching to

Stuart

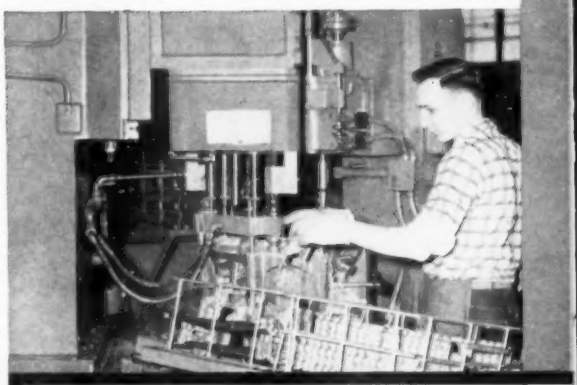
DASCO D-20

HEAVY-DUTY SOLUBLE OIL

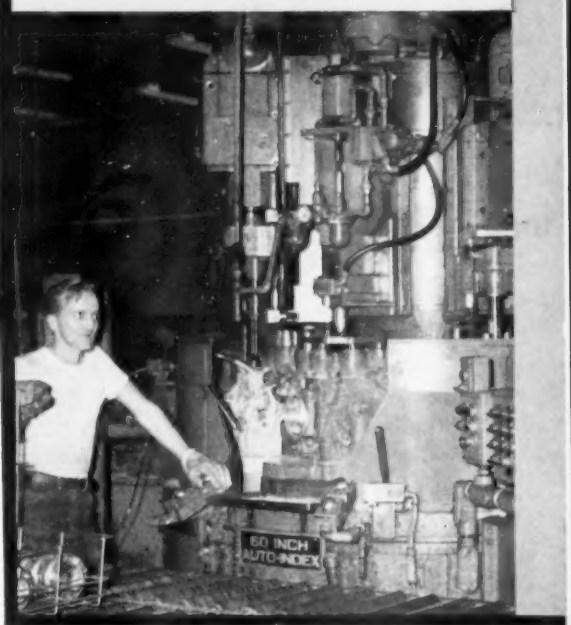
An actual saving of $7200 per month, including labor costs, has been reported by a large automotive transmission plant since switching to Stuart's Dasco D-20—*the first truly heavy-duty soluble oil* formulated and priced for general application!

ONE OIL FOR 365 DIFFERENT MACHINES—This carefully engineered compound eliminates cutting oil confusion—drastically reduces the number of cutting fluids needed in your plant. This plant uses economical Dasco D-20 in standard mixtures on *365 different machine tools*—reducing cutting oil inventory . . . saving service time and cutting oil costs . . . minimizing chance of error—yet taking advantage of all lubricating and cooling properties you expect from a heavy-duty soluble oil.

RANCIDITY ELIMINATED—This user reports that Stuart's Dasco D-20 stays sweet longer—even after long shutdowns. Rancidity is actively resisted by a special germicide additive, the best of a very few germicides that remain effective in the presence of soaps. Stuart's Dasco D-20 has superior wetting ability—remains effective when mixed with water.



Chips settle faster with Stuart's Dasco D-20, so you have a clean compound in your machine at all times. You get a better finish . . . cooler cutting and grinding.



You can use low-priced Stuart's Dasco D-20 for reaming, boring, drilling, facing, chamfering, milling, tapping, threading, broaching, surface-grinding, and high-speed carbide tool machining.

For Cutting and Grinding

Stuart's Dasco D-20 maintains or improves efficiency of your cutting and grinding operations. A real heavy-duty emulsifiable oil, it forms a tough, thin film between the cutting tool and the work . . . reducing friction and preventing excessive heating. A wide variety of tough metal-cutting operations, including certain types of broaching, can be done with this *one* low-priced compound. A lean mixture for grinding enables you to take full advantage of improved wheel bonds. Properly applied, it allows you to use high-unit pressure for maximum stock removal . . . keeps wheels open and free-cutting . . . prevents heat checking.

First low-priced heavy-duty soluble oil with both additives: active germicide and E. P. base

Stuart's Dasco D-20 is the first low-priced soluble oil to offer you both a special anti-rancidity germicide and an extreme pressure base oil additive with high anti-weld and lubricity characteristics. Carefully balanced, high-quality emulsifying agents provide high-grade cooling properties . . . unusual stability for longer life. This multi-purpose, heavy-duty soluble oil gives you ideal characteristics for high-speed machining with carbide cutting tools . . . upgrades finish and tool life on tool steel applications. Stuart's Dasco D-20 has superior wetting ability . . . avoids rust . . . mixes easily . . . keeps machines and parts clean . . . and is preferred by operators.

Find Your STUART Rep. In The Yellow Pages

Phone your Stuart Service Center

Arrange now to test Stuart's Thermex 33 Hot Die Lubricant on your difficult forging and drawing operations.

DETROIT, MICH. . . . . Tyler 7-8500
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CLEVELAND, OHIO . . . . . Prospect 1-7411
PHILADELPHIA, PA. . . . . Devonshire 8-6100
TORONTO, CANADA. . . . . Oxford 9-9397

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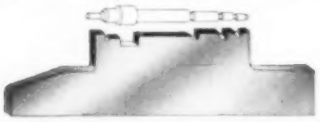
Stuart

METALWORKING LUBRICANTS

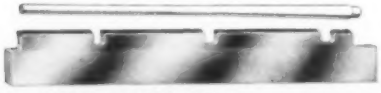
Talide® Blades . . .
THE No. 1 CHOICE OF CENTERLESS GRINDER OPERATORS!

Above view shows Landis Centerless Grinder in operation. Talide-tipped work rest blades have been supplied as initial equipment on many Landis Centerless Grinders.



LARGE ELECTRIC MOTOR PLANT

Part . . . . . . Stainless Steel Rotor Shaft for Electric Motor.
Operation . . Grind 7 diameters simultaneously.
Machine . . . No. 12 Landis Centerless Grinder.
Blade . . . . . Special multiple step Talide-tipped work support blade No. C-4884.
Results . . . . Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



LEADING ARMS PRODUCER reports outstanding service life with Talide centerless blades over past 10 years—outperforming and outlasting all other work support blades.

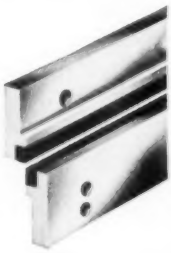
Part . . . . . . 12 gauge shotgun barrel.
Operation . . Grind entire gun barrel simultaneously to series of compound angles.
Machine . . . No. 5 Cincinnati Centerless Grinder.
Blade . . . . . Special Talide-tipped work support blade 34⅜" long, having 9 steps and 10 compound angles ground to .0001" tolerance.
Results . . . . Talide-tipped blades last 150 days per grind—hardened steel blades 3 days. Several Talide blades have been in continuous production for over 5 years—being retipped with a new Talide metal wear strip every 12 to 18 months.

Over 50 sizes and styles of standard blades carried in stock—with special blades made promptly to order. Write for 76-page catalog 56-G or ask for sales engineer to call.

TALIDE ROTARY KNIVES GIVE PHENOMENAL RUN OF 90-1 . . .

A leading strip steel producer of razor blade, high-carbon, spring and stainless steel reports over 1200 coils were gang slitted with Talide knives, compared to 15 coils with steel knives. More tonnage was produced in one regrind of the Talide knives than over the entire life of a set of steel knives. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

$18,000 SAVED USING TALIDE SHEAR BLADES



A large electric motor manufacturer, shearing .014" silicon steel for transformers, advises first-year savings of $18,000 in blade costs after completely equipping their press line with Talide-tipped blades in lengths ranging from 15" to 87". Talide shear blades are averaging 1,000,000 cuts per grind compared to 10,000 cuts obtained with steel blades.

METAL CARBIDES CORPORATION
Youngstown 12, Ohio

EXCLUSIVE RETIPPING SERVICE

Because of its exclusive hot press method, Metal Carbides is able to rework worn, chipped out or broken areas of carbide-tipped blades back to original size and dimension with all breaks and defects eliminated.

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

RIVETT SQUAREMASTER "100" CYLINDERS

Unfailing POWER for MILLIONS of cycles!

Here's sure power for unfailing cylinder operation. SQUAREMASTER 100's are the world's finest constructed cylinders—perform with 100% efficiency! 200 P.S.I. air to 500 P.S.I. oil. Available in 7 mountings with standard dimensions, in 10 bore diameters, internal and external threading. Special models and cover combinations. Priced competitively; prompt delivery; meet all J.I.C. requirements.

RIVETT, INCORPORATED
Dept. TE-5, Brighton 35, Boston, Mass.

*Initial High Coefficient of Static Friction

POWER-PACKED FEATURES PROTECTED BY POWER-GUARD CONSTRUCTION

1. Piston rod. Ground and polished alloy steel. Hard chrome-plated. **2.** Piston rod bearing. Replaceable cartridge-type. **3.** Piston packing adjusts automatically. V-block packing minimizes friction. **4.** Correctly stressed tie rods. **5.** Cushion bushings. Bronze, floating type. **6.** Ports rotated to any 90° position. **7.** Steel covers. Take minimum mounting space.

Send for catalog. Proof of SQUAREMASTER efficiency stated in these 20 pages. Write today.

RIVETT furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

Member — National Fluid Power Association

LOOKING FOR MORE FROM

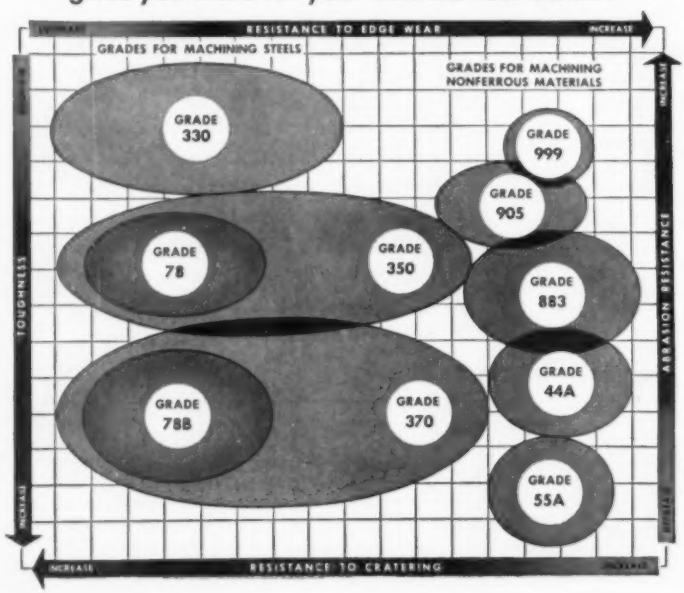
USE CARBOLOY® GRADE 78B General-Purpose carbide for top production—with low initial tool cost—on your steelcutting jobs

Long before anyone ever heard of "premium" carbides, Carboloy Grade 78B was doing a top-notch job as a high-quality, general-purpose steelcutting grade. It's *still* doing it—in thousands of plants where job requirements don't demand a carbide like Extra-Performance Grade 370.

On general-purpose steelcutting jobs, Grade 78B's lower initial cost pays off . . . and pays off handsomely. What's more, even on *tough* jobs, where runs are short, Grade 78B may prove itself the most economical carbide to use.

If you're not now using Grade 78B for general-purpose machining—or its companion, Grade 78 for finishing and light roughing—chances are you *should!* Order these two low-cost carbides from your Authorized Carboloy Distributor . . . today.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!



YOUR CARBIDE TOOL DOLLAR?

USE CARBOLOY® GRADE 370 Extra-Performance carbide on tough steelcutting jobs, for lower cost-per-piece, and long production runs

Carboloy Extra-Performance Grade 370 is the carbide to use where tool-cost-per-piece on heavy-duty jobs is eating up company profits. And it pays off, too, where production schedules demand longer-lasting tools to keep high-production machines in continuous profitable operation.

Grade 370 is the carbide everybody tries to match when it comes to roughing and interrupted cuts. But nobody does. Grade 370 stays sharp longer—at higher speeds and feeds—than any other heavy-duty carbide on the market.

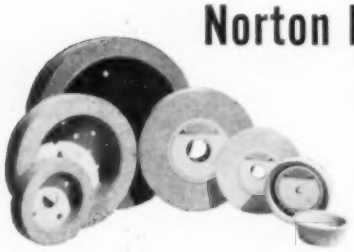
Today, thousands of metalworking men are realizing significant production economies on heavy-duty jobs because Extra-Performance Grade 370 more than lives up to its name. Together with the other Carboloy Extra-Performance carbides—Finishing Grade 330 and Medium-Duty Grade 350—it can help you put a halt to declining profits. Just order from your local Authorized Carboloy Distributor. Then count the extra production you'll get . . . at lower cost-per-piece!

To get all the facts on Carboloy Extra-Performance Grades 330, 350, and 370—and General-Purpose Grades 78 and 78B—write: Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Blvd., Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

Fishing for



Norton K† Bond CRYSTOLON* wheels bring big advantages to offhand grinding

Here's a combination of vitrified bond and silicon carbide abrasive that delivers remarkable results — particularly in offhand sharpening of single-point carbide tools. You can get these wheels in dense, medium, or porous structure — for most efficient action regardless of the area of contact.

Also, CRYSTOLON abrasive is made in green or gray types—green, 39C, being first choice in a majority of carbide applications.

In addition, half-grade increments of hardness are available, enabling us to "pin-point" wheel specifications to minimize your grinding costs.

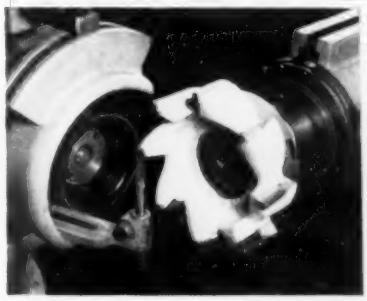
And the Norton K Bond is one of the most radically improved vitrified bonds ever developed. One big advantage is: *it assures closest possible duplication of wheel specifications.* Which means that every time you reorder K Bond wheels you get exactly the same top performance.

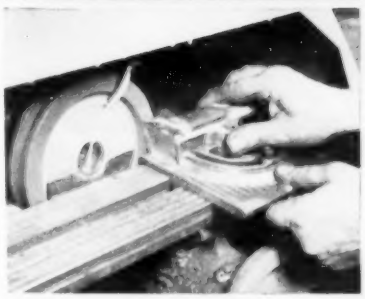
carbide grinding economies?

Catch 'em all fast— with the finest lures made

You cut grinding costs to rock bottom with Norton's outstanding wheel selection and service

Norton Diamond Wheels, mined or man-made . . . carbide grinding's Certified Crown Jewels





Norton was first to introduce all three bond types of diamond wheels: resinoid, vitrified and metal . . . does all its own checking and sizing of diamonds . . . duplicates wheel specifications with constant accuracy.

Resinoid bonded wheels are best for such jobs as precision grinding of cutters, form tools and die blanks. These wheels are available in several resinoid bond types — B type for wet grinding — B6 type for dry grinding.

Vitrified bonded wheels are used for sharpening single-point cutting tools, grinding chip grinders and for surfacing carbide dies.

Metal bonded wheels are sometimes preferred for grinding chip breakers, for certain offhand grinding jobs, and for cutting off sintered carbide blanks, etc.

Norton leadership in diamond wheel manufacture continues whether the diamonds used are natural or man-made. And with each Norton diamond wheel you get a certificate of diamond concentration. Signed by the President of the Company, this certificate is your safest possible buying guide.

W-1843

The Complete Line, Completely Serviced

Norton not only supplies the most extensive line of wheels for carbide grinding. As the world's largest producers of abrasives it maintains the most modern equipment designed for product quality control. Expert engineering assistance and prompt deliveries are also geared to provide the wheels you need for top quality, lowest cost carbide grinding. For these helpful services, see your Norton Abrasive Engineer or Distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES
Making better products... to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries †Patent applied for

New Dow epoxies feature "lens clear" liquid resin

Dramatic evidence of the striking clarity and purity of Dow Epoxy Resin 332—unique member of Dow's new line of liquid epoxy resins—is shown in the illustration above. The magnifying lens was actually cast from this new water-clear resin. In addition to improved clarity and uniformity, DER 332 has very low viscosity, longer pot life and greater heat resistance than conventional epoxies.

Also available, for formulations where absolute purity is not so important, are Dow Liquid Epoxy Resins 331 and 334.

Dow's position as a basic producer of all epoxy raw materials assures top quality control and a narrower range of specifications. It will also enable Dow to introduce, in the near future, a complete line of solid epoxy resins and a new line of polyfunctional liquid epoxy resins outstanding in high temperature service.

Prompt delivery of these three Dow Liquid Epoxy Resins can be made in drums, truck or tank car lots. For more information contact your nearest Dow sales office or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Dept. 2259M.

EPOXY

YOU CAN DEPEND ON DOW

now change tools in seconds on your Bridgeport milling machine!

NEW MICROBORE FLASH-CHANGE SPINDLE MAKES IT POSSIBLE

Custom designed for Bridgeport Model J Milling Heads, now available from stock.

Easily installed, the new Microbore spindle equips any Bridgeport for Microbore Flash-Change Tooling. This quick change system increases productivity and reduces downtime on all milling, drilling and boring operations.

The Flash-Change Socket, an integral part of the spindle, combines maximum strength and rigidity for roughing with extreme accuracy for precise finishing operations. A full range of standard Flash-Change Adapters for end mills, shell end mills, drills, drill chucks and one- or two-tool Standard Microbore Boring Bars is also available.

Return the attached coupon for complete information on another Microbore first!

DEVLIEG MICROBORE® SYSTEM

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

Please send me . . . ☐ **Complete Information on the New Microbore Flash-Change Bridgeport Spindle**

☐ **Comprehensive Microbore Catalog**

NAME

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. . . attained with the New SIP HYDROPTIC 6A Jig Boring and Milling Machine

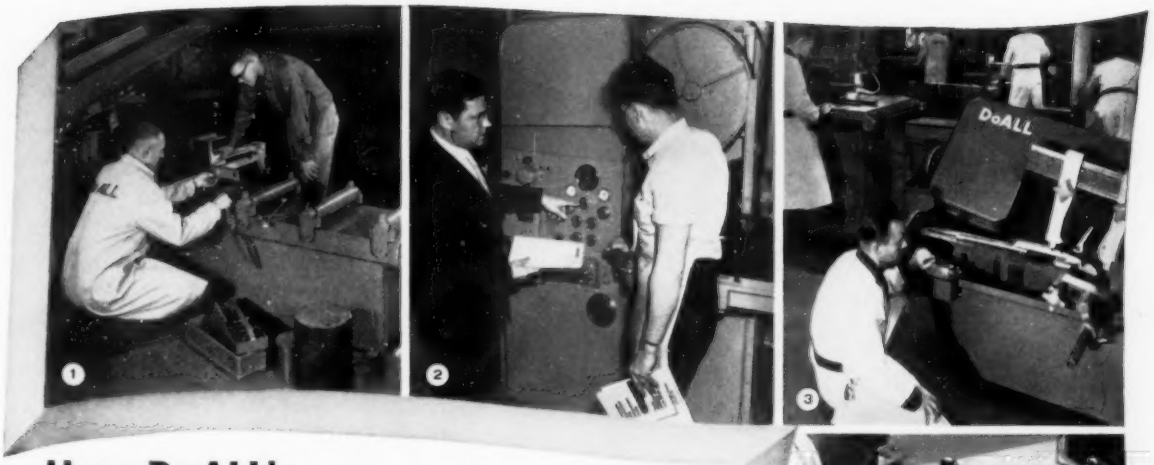
Due to unprecedented cutting ability . . . increased range and capacity . . . simplification of controls . . . and ease of operation, the HYDROPTIC 6A is unmatched in performance.

Up to **30% increase** in productivity has been realized with the AUTOMATIC COORDINATE REPEATING DEVICE DIR (optional equipment) which repeats successively the initial settings made during the machining of the first workpiece.

For complete information, send for Catalog No. 1149.

As with all SIP HYDROPTICS, *accuracy is based on* SIP *High Precision* STANDARD SCALES.

AMERICAN SIP CORPORATION • 100 EAST 42 STREET, NEW YORK 17, N.Y.



How DoALL's "Continuous SERVICE" insures profitable operation with DoAll Machine Tools

7-point program of interest to all plant executives

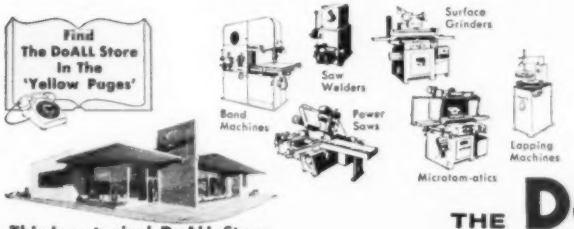
To keep your DoALL machines producing at the highest possible profit, The DoALL Company offers a 7-point User-Help Program—far beyond any other service in the industry.

1. **FREE INSTALLATION SERVICE** to assure correct setup and full protection during initial operation.
2. **FREE OPERATOR TRAINING** certifies every operator you assign. In addition to personal instruction, special help includes "tip-sheets," wall charts and handbooks on latest techniques.
3. **FREE MACHINING ANALYSIS** is our specialty to keep your DoALL machines at full efficiency as new materials, new jobs and special requirements develop in your production.
4. **FREE MACHINE FIXTURING** helps to obtain peak performance in production of duplicate parts. Service includes sketches, recommending fixtures proved on similar jobs. Saves your time and money . . . prevents costly, needless experiments.
5. **FREE JOB-SPOTTING** within your plant keeps your DoALL machines busy. We can evaluate many jobs you may have overlooked—jobs your DoALL machines can do at lower cost.
6. **FREE MACHINE INSPECTION** — periodic inspection includes minor adjustments and reporting signs of wear—with timely tips to correct these conditions. Written Certificate of Inspection is furnished.
7. **DoALL PACKAGE SERVICE** provides a uniform, high-quality service at lowest possible costs from basic overhaul to production maintenance and modernization. Safeguards your DoALL machine investment . . . assures continuous profitable returns.

These exclusive services are administered by over 200 factory-trained engineers, one of whom is located *near* your plant.

CALL TODAY FOR FREE MACHINE CHECKUP

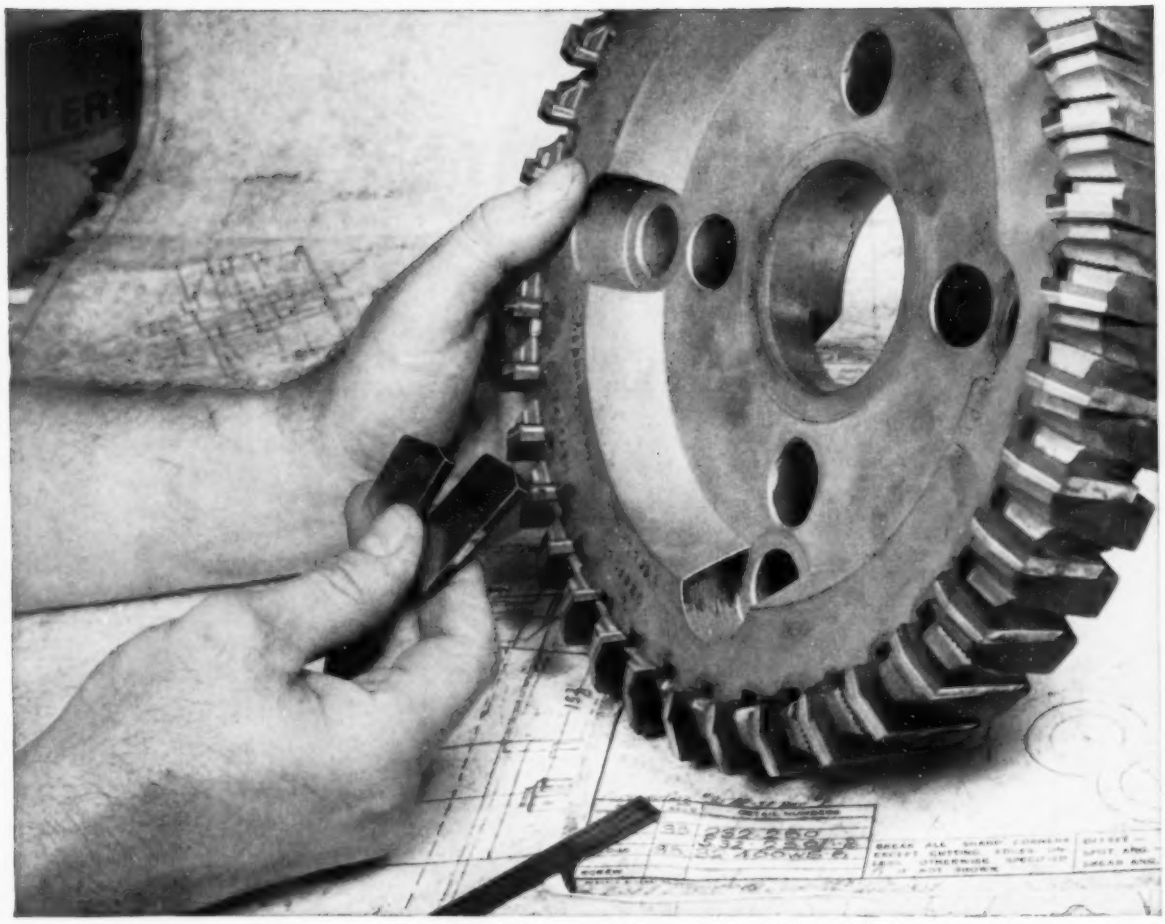
Ask your nearby DoALL store to give your DoALL machines a complete inspection and operation test—free of charge!



This is a typical DoALL Store

S-1

THE DoALL COMPANY, Des Plaines, Illinois



Ingersoll Close-Bladed Shear Clear Face Mill for high feed rates on production equipment.

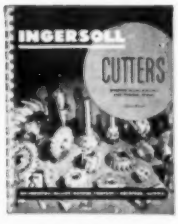
Is This Good Blade Life?

The answer is "yes" only if a maximum number of parts were produced. If the blades were badly chipped and only used a few times, it was a costly operation.

This is only one of the factors which determine tool costs in your shop.

To develop the lowest milling costs requires a complete study of feed rates, cutting speeds, finish requirements, depth of stock and when to change cutters. It's part of our service to work with you in considering these and other factors before recommending any cutter.

We will welcome an opportunity to tell you more about this service. Write:

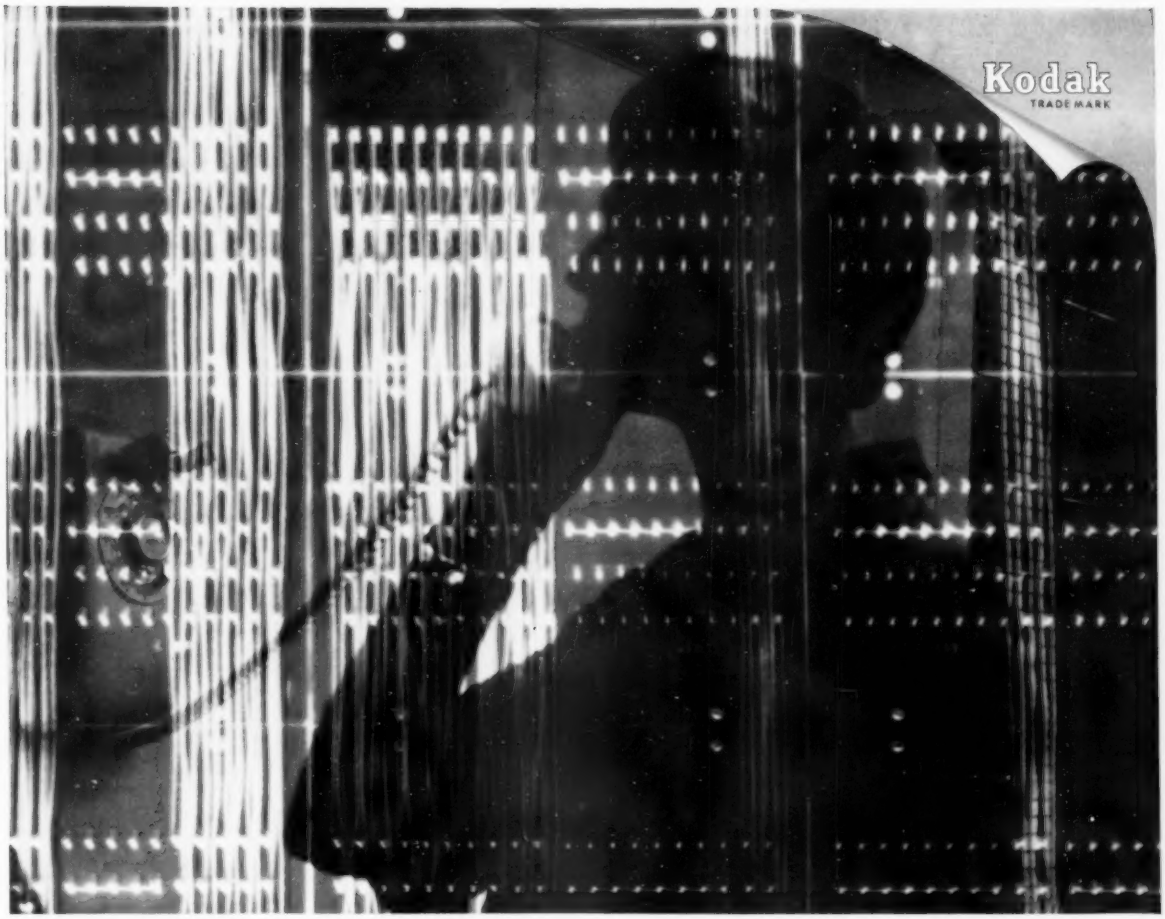


If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #66F

CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

505 FULTON AVENUE · ROCKFORD, ILLINOIS



Here's a case where optical gaging is the only practical answer

The heart of the central dial switching system made by Stromberg-Carlson, Division of General Dynamics Corporation, is the XY* Universal Switch.

A key "muscle" in this heart is a small wiper spring, whose 24 exact dimensions resisted measurement by mechanical means. Yet any flaw in this critical component could seriously impair telephone service.

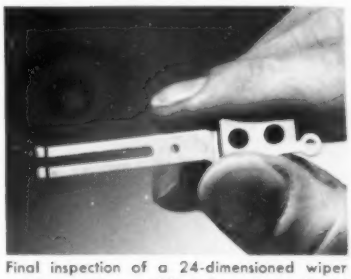
With the Kodak Contour Projector all 24 dimensions of this wiper spring are optically gaged to tolerances of ± .0005"—and the job takes just *three minutes.*

In this case Stromberg-Carlson found that optical gaging was the *only* practical inspection method. Special mechanical gages could have been devised, but then inspection would have taken—not three minutes—but as much as an hour per part.

Because Stromberg-Carlson makes and uses a wide variety of complex, hard-to-inspect products, the company uses 9 Kodak Contour Projectors in its Telecommunication Division, alone. They solve problems in receiving, production, and tool inspection as well as in final inspection.

If you have a gaging problem that involves close-tolerance measurement of precision parts with many dimensions, you can probably solve it best with a Kodak Contour Projector. To find out how optical gaging can help you, send for the booklet "Kodak Contour Projectors."

*XY is a registered trademark of Stromberg-Carlson



Final inspection of a 24-dimensioned wiper spring, a vital part of Stromberg-Carlson's dial switching mechanism, is practical only with optical gaging.

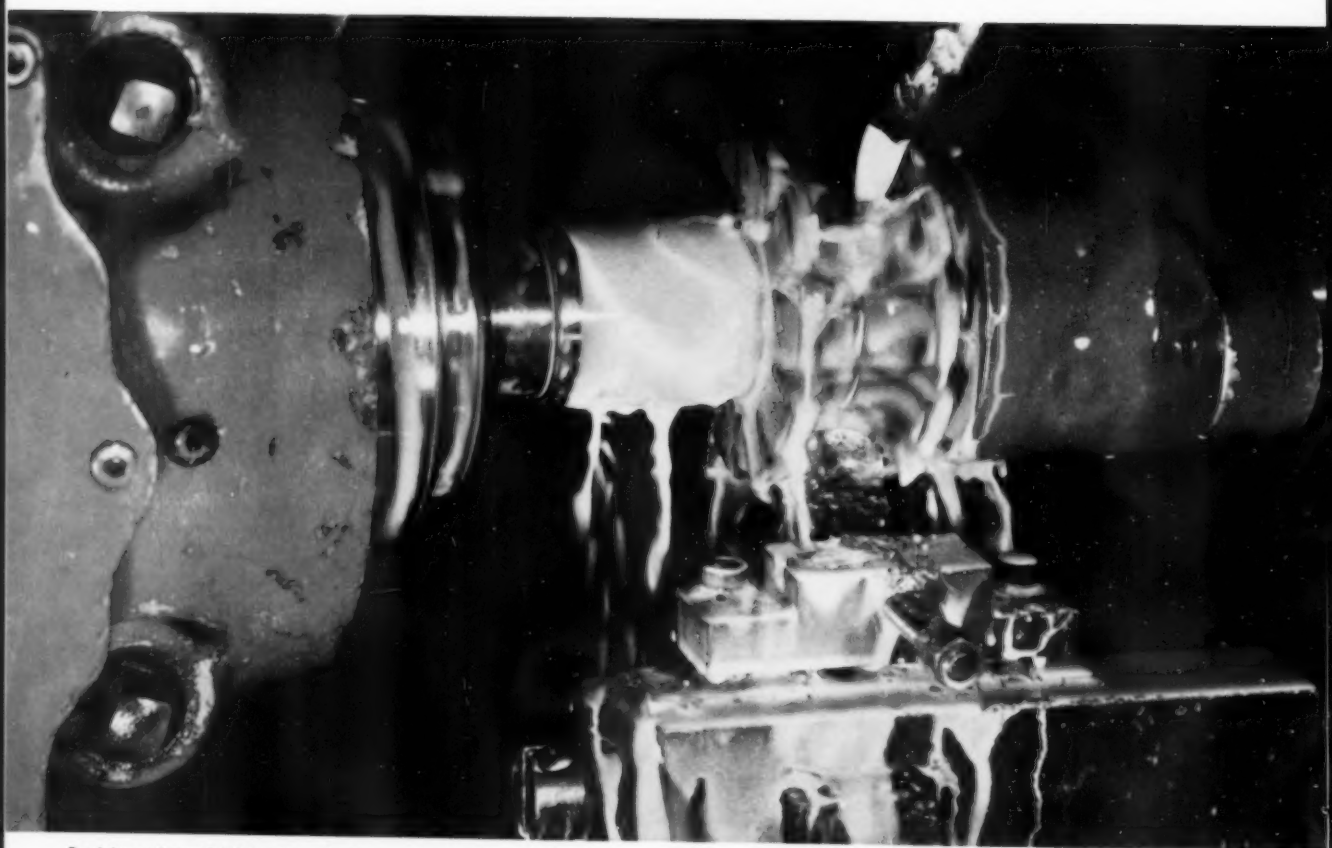
In another inspection area, an operator easily measures the critical dimensions of a relay lever arm with a Kodak Contour Projector to assure exact tolerances.

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Wheels and machines stay cleaner with emulsions of new S.E.C.O. Also, finishes are better.



Emulsions of new S.E.C.O. allow faster cuts with less tool wear.

Photos courtesy of
Peter Salmon Co., Glenside, Pa.

NEW EMULSIFYING OIL KEEPS MACHINES CLEAN, PROTECTS AGAINST RUST, GIVES IMPROVED HARD-WATER EMULSION STABILITY

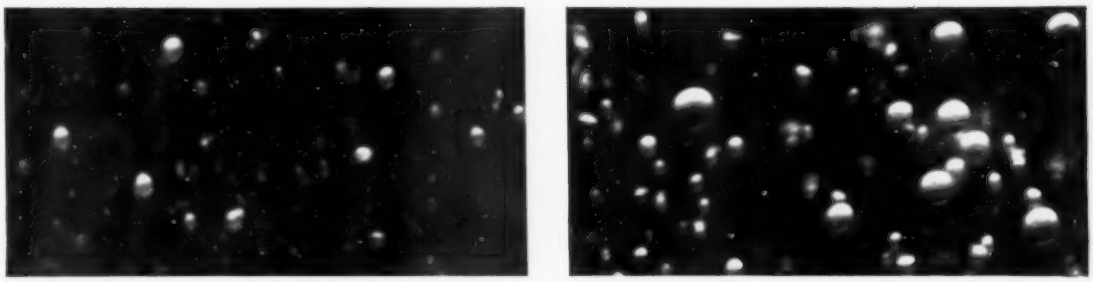
Emulsions of Sun's new S.E.C.O. (Sunoco® Emulsifying Cutting Oil) with smaller oil particle size give you the following benefits—

EMULSION STABILITY—In hard-water areas, impartial field tests show that emulsions of *new* S.E.C.O. stand up better under more severe conditions than those made with other regular emulsifying cutting oils.

DETERGENCY—The excellent wetting properties and detergency of *new* S.E.C.O. allow dirt and fines to settle quickly out of emulsions. Grinding wheels and machines stay cleaner.

RUST-PREVENTION—The smaller oil particle size in emulsions of *new* S.E.C.O. gives better metal wetting properties and increased protection against rust and corrosion. See photos below.

If you're a regular user of S.E.C.O., notice how much it has been improved. If you're not, find out what we mean about greater economy and improved production with *new* Sunoco Emulsifying Cutting Oil. Call your Sun representative, or write to Sun Oil Company, Philadelphia 3, Pa., Dept. I-9.



800x photomicrographs of 10% emulsions. *New* S.E.C.O. emulsion on left contains *8 times* as many oil particles per unit volume as ordinary emulsion on right. Many minute particles in S.E.C.O. emulsion do not show at this magnification.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

©Sun Oil Co., 1958

WILSON "ROCKWELL" HARDNESS TESTERS

WORLD'S STANDARD OF ACCURACY

ACCO for Better Values

EQUIPMENT for EVERY Hardness Testing Requirement

No matter what your hardness testing requirements are, there's a WILSON "ROCKWELL" instrument to do the job. Choose from this complete selection of hardness testers:

"ROCKWELL"—for most hardness testing functions.

Superficial—for extremely shallow indentations.

Twintester—combines functions of "ROCKWELL" and "ROCKWELL" Superficial testers.

Semi-Automatic (manual feed) and Fully Automatic—for automatically classifying tested pieces as CORRECT, TOO HARD, or TOO SOFT—at test rates up to 1000 pieces per hour.

Special Machines—for testing large objects, obtaining internal readings, and other unusual applications.

ALL WILSON "ROCKWELL" hardness testers provide these advantages:

Accurate performance—precision built, with exact calibration, for consistently correct results.

Long life—durable as a machine tool.

Easy operation—even an unskilled operator can get perfect readings. All controls conveniently grouped.

Easy maintenance—interchangeable mechanisms, with spindles mounted on oil-less bearings.

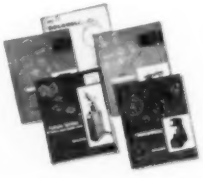
DIAMOND "BRALE" PENETRATORS

for perfect testing every time

A perfect diamond penetrator is essential to accurate hardness testing. Since one point of hardness on the "ROCKWELL" scale represents only 80 millionths of an inch of penetration—only 40 millionths on a Superficial tester—the slightest imperfection will cause a false reading.

Only *perfect* Wilson Diamond Brale Penetrators are sold. Each diamond is flawless, with no chips or cracks. It's cut to an exact shape. Microscopic inspection and a comparator check of every diamond—one at a time—assure this perfection—and assure you of accurate hardness testing every time.

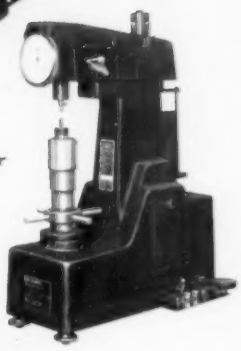
A COMPLETE LIBRARY of Helpful Information



A wide variety of bulletins tells about hardness testing, and describes the many instruments, accessories, and services Wilson offers. Write for your choice:

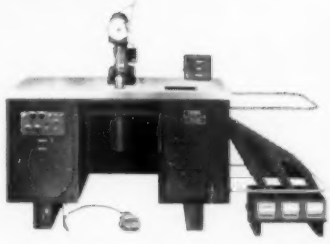
DH-325—WILSON "ROCKWELL" Hardness Testers • **DH-326**—"ROCKWELL" Superficial Hardness Testers • **TT-58**—"ROCKWELL" Twintester • **DH-327**—Special "ROCKWELL" Testers, including Automatic and Semi-Automatic models • **DH-328**—TUKON Tester, for precision MICRO and MACRO testing

"ROCKWELL"



Twintester

Superficial



Automatic

TUKON Tester (for MICRO and MACRO testing)

ACCO **WILSON**

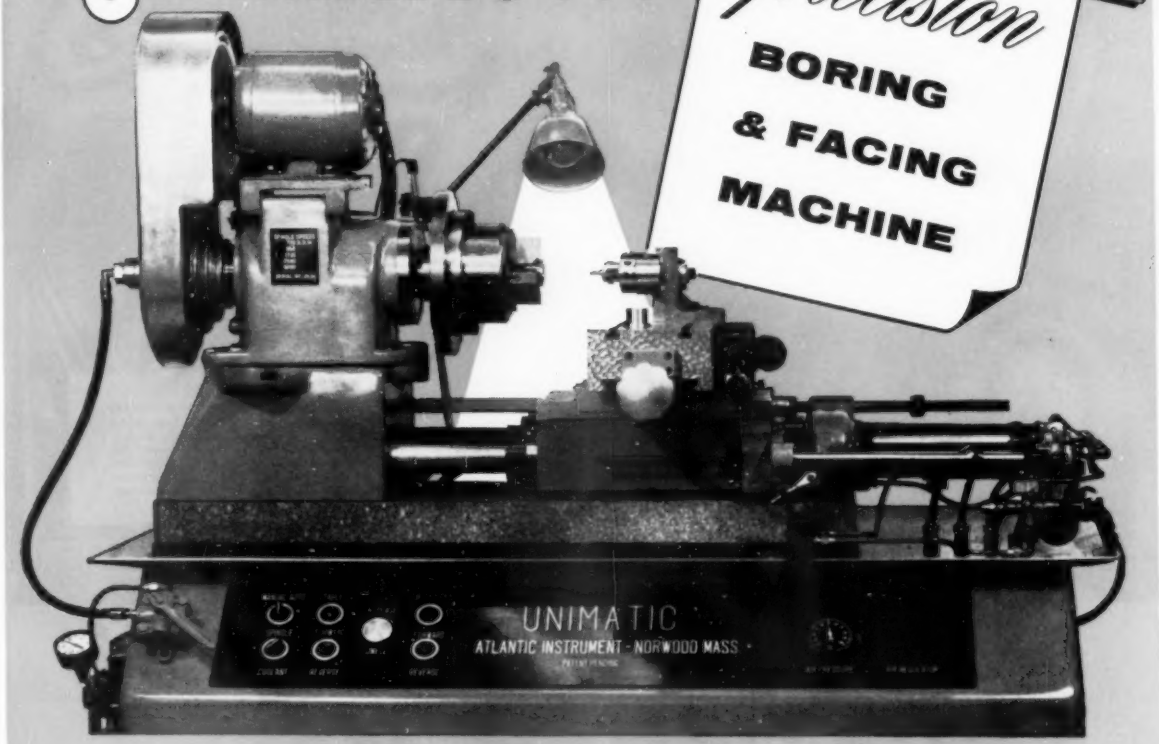
MECHANICAL INSTRUMENT DIVISION

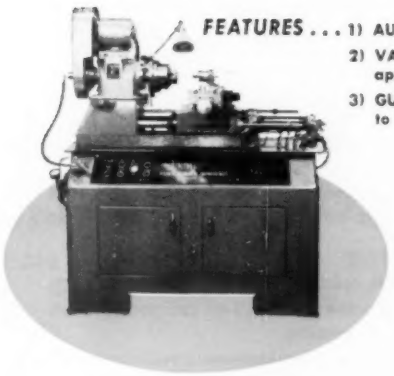
AMERICAN CHAIN & CABLE

230-H Park Avenue, New York 17, N.Y.

UNIMATIC...

HIGH *precision* BORING & FACING MACHINE





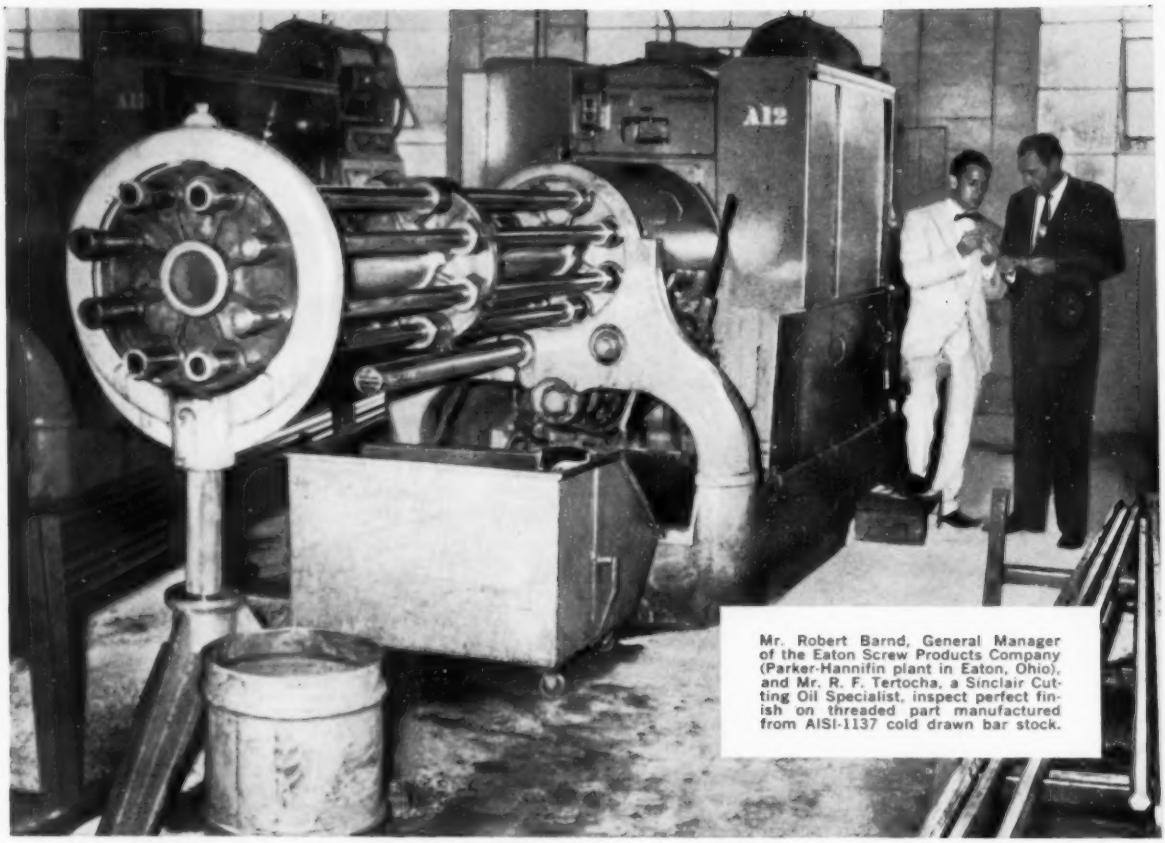
FEATURES . . . 1) AUTOMATIC CYCLING
2) VARIABLE FEED approaches and returns
3) GUARANTEED to hold work to .0002"

Designed and built by ATLANTIC INSTRUMENT COMPANY for their own use . . . and now offered as a type and size of machine for which there is a strong demand, especially in the instrument and allied industries, where close tolerances must be held.

The UNIMATIC *comprises an extremely accurate machine element, mounted on a granite base scraped to a tolerance of .00005", with other features (fully explained in our catalog) neutralizing the effects of temperature variations.*

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



Mr. Robert Barnd, General Manager of the Eaton Screw Products Company (Parker-Hannifin plant in Eaton, Ohio), and Mr. R. F. Tertocha, a Sinclair Cutting Oil Specialist, inspect perfect finish on threaded part manufactured from AISI-1137 cold drawn bar stock.

EATON REPORTS 5 ADVANTAGES WITH CLAIRO® 16...

"Why use 3 different cutting oils on your automatic screw machines *when one will do the trick?*" That's how R. F. Tertocha introduced Sinclair's new cutting oil, CLAIRO 16, to Bob Barnd. And that's when Eaton Screw Products Company started to cut their costs.

5 DISTINCT ADVANTAGES After switching to CLAIRO 16, Mr. Barnd enthusiastically reported these 5 distinct advantages . . .

1 One oil for all metals which Eaton machines.

2 Reduction in cutting oil and lubricating oil inventory.

3 No contamination of non-corrosive oils with corrosive types when chips pass through chip wringer.

4 No need to remove cutting oil from machine reservoir when machine is set up to run either ferrous or non-ferrous parts.

5 Light color makes it possible for operators to see readings on calipers, scales and micrometers.

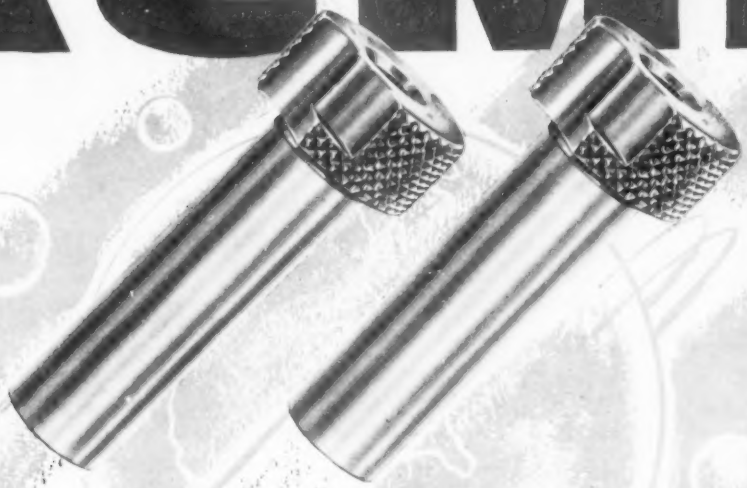
DUAL-PURPOSE OIL Of further importance to Eaton—this high-quality oil can also be used as a machine tool lubricant. CLAIRO 16 replaced the lubricating oil Eaton was using on a battery of 31 automatic screw machines.

You, too, can benefit from the advantages of CLAIRO 16. Contact your local Sinclair Representative or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS AND COOLANTS

ACME

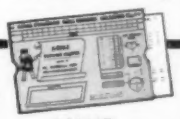


QUALITY... PRECISION... *and Fast Delivery!*

Wild claims? Never! Not with Acme supplying each for over 35 years. If you want the very best, and we are sure you do, always buy your drill jig bushings from Acme through our many distributors.

ACME
INDUSTRIAL CO.
208 North Laflin Street
Chicago 7, Illinois

Acme's concerted effort to supply your needs has built a strong national distribution system. All standard bushings and dowel pins are stocked by your local distributor. Try his service. We believe it's unbeatable.



SEND ME YOUR FREE DRILL BUSHING SELECTOR —206

NAME _____

FIRM NAME _____

ADDRESS _____

CITY _____ STATE _____

form INTERNAL THREADS

BESLY X-PRESS® TAPS

- Eliminate tap breakage due to chips
- Stronger because there are no flutes
- Produces stronger threads by compacting metal
- No cutting edges to wear down
- Provide fewer tool changes for more pieces per shift
- No chip interference permits tapping to bottom of blind holes
- Reduce plating failures, no chips in bath
- Drill breakage reduced especially in smaller sizes, because larger tap-drills used
- Recommended speeds higher than for conventional tapping
- Speed cycling time for automatic machine tapping
- Reduce cost per tapped hole wherever successfully applied

TESTED . . . PROVED

Aluminum Screw Machine Part—
Company gained 27,000 threaded holes per X-Press Tap vs 800 per conventional tap previously. Cycling time reduced from 6.4 to 3.6 seconds.

Zinc Die Cast Part—
Maker now gets 20,000 to 25,000 threaded holes with X-Press Taps, opposed to only 1000 before. Tap breakage due to chips was also eliminated.

Seamed Copper Telephone Part—
10,000 average threaded holes per X-Press Tap now achieved by this producer vs less than 200 by former method with conventional taps.

½ Hard Brass Screw Machine Part—
Phenomenal results by this user — 300,000 pieces per X-Press Tap, 250 previously. Excessive conventional tap breakage caused low rate before.

Names and Data Furnished on Request

BESLY HAS A COMPLETE TAP LINE FOR EVERY JOB

Straight Pipe Taps

Taper Pipe Taps

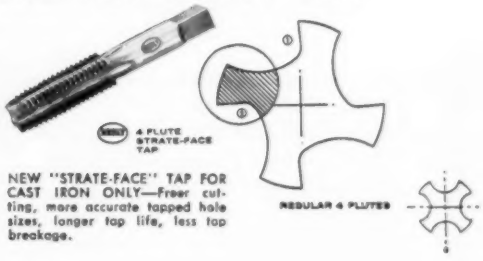
Standard Hand Taps

Standard Machine Screw Taps

Spiral Point Machine Screw Taps

Spiral Point Hand Taps

Fluteless Spiral Pointed Taps



NEW "STRATE-FACE" TAP FOR CAST IRON ONLY—Freer cutting, more accurate tapped hole sizes, longer tap life, less tap breakage.

STANDARDS — immediate delivery. MODIFIED STANDARDS and "SPECIALS" — fast

without cutting

New Revolutionary Tapping Principle Cold Forms Internal Threads In . . .

- COPPER
- ALUMINUM
- BRASS
- LEAD
- ZINC
- DIE CASTINGS
- LEADED STEELS
- OTHER DUCTILE METALS

CONVENTIONAL TAPPING METHOD
Produces chips that may clog flutes, cause loading. Result—excessive breakage.
Grain lines of metal are cut.
CHIPS

BESLY X-Press Tapping is a cold forming or swaging process for producing internal threads in ductile metals. The desired thread is formed under pressure. The grain fibers follow the contour of the thread, as in good forgings. They are not cut away as in conventional tapping methods. Complete application details are available — see your Besly distributor, or send coupon. *Where this new tool can be successfully applied the results are* phenomenal! *It would pay you to try them yourself — NOW!*

"SR" Style X-Press Taps—for through or bottoming holes.

"P" Style X-Press Taps—for through holes, or bottoming holes with ample clearance.

"B" Style X-Press Taps—for bottoming holes only.

"PC" Style X-Press Taps—same work as "P" Style series, except the root diameter controlled at 75% of thread.

SEE YOUR BESLY DISTRIBUTOR or send coupon

Engineering, Service and Specials . . . are a Besly Specialty

BESLY

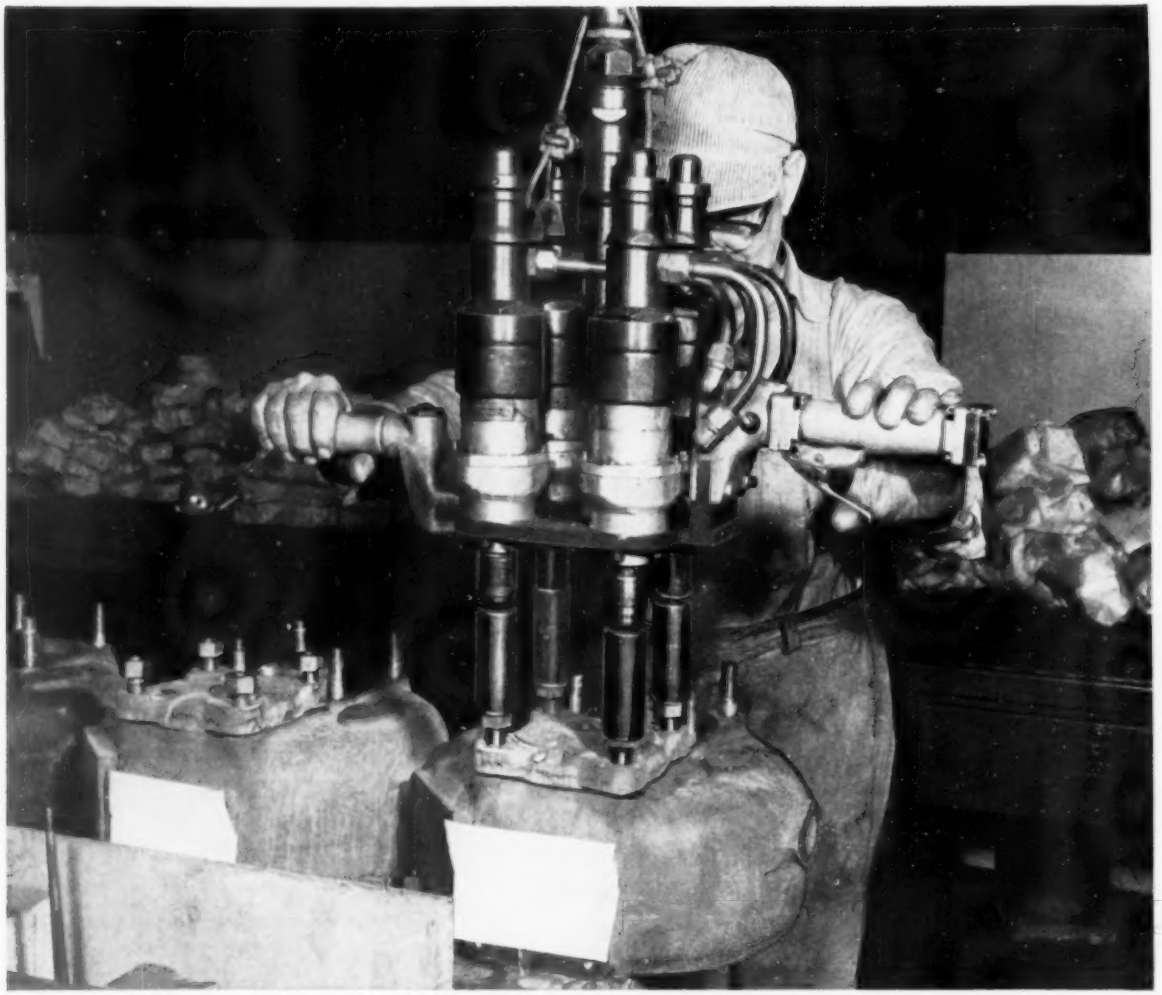
BESLY-WELLES CORPORATION
Est. as C. H. Besly & Co. 1875
118 Dearborn Ave., South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps • Drills • Reamers • End Mills • Tool Bits • Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders

CLIP TO YOUR LETTERHEAD

Send X-Press Tap data ..... ☐
Send Drill Catalog ..... ☐
Carbide Catalog ..... ☐
Gage Catalog ..... ☐

Your Name_____



Four-spindle Gardner-Denver (Keller) multiple nut setter drawing up valve cover nuts on air compressor cylinder head—assures accurate torque control even on short production runs such as this.

Fast, accurate nut setting for any type production setup

Keep high-production pace

Increase the pace of your high-volume assembly lines with Keller multiple nut setters. They're fast—yet always accurate. You simply set them to the exact torque required . . . put them to work . . . forget them.

Made of standardized components, these versatile nut setters pay off in a hurry. They save time . . . are highly adaptable to a wide variety of jobs.

Speed low-production runs

For relatively low-production jobs such as the one pictured above, Keller multiple nut setters also cut time and costs. You run many nuts at once . . . assemble units faster. You eliminate manual torque wrench checks with accurate torque control . . . cut labor costs.

Standardized components make switching from job to job quick and easy. When the bolt pattern changes, simply move the standard spindles and handles to a new job-tailored mounting plate.

Very likely there are money-saving applications for Gardner-Denver's Keller multiple nut setters in your plant. Contact your Gardner-Denver representative for complete details.

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Grinding to ±0.000010" or less
in production – with average operators

...clearance of mating parts held to ±0.000020" or less

NOW . . . from Brown & Sharpe—comes the answer to space-age precision demands . . . the new CEDA SIZE arrangement for the No. 5 Plain Grinding Machine, and the ELECTROMATE attachment.

With electronic efficiency, CEDA SIZE saves you the extra time and exceptional skills now devoted to lapping and other methods of precision sizing. You get exact duplication, within a few millionths, on high precision parts needed for missiles, fuel injectors, instruments, etc.—on a *production* basis, with operators of limited experience.

Find out how CEDA SIZE can solve your toughest "tolerance headaches." For full information, write: Brown & Sharpe Mfg. Co., Providence, R. I.

PROGRESS IN PRECISION > FOR 125 YEARS

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES

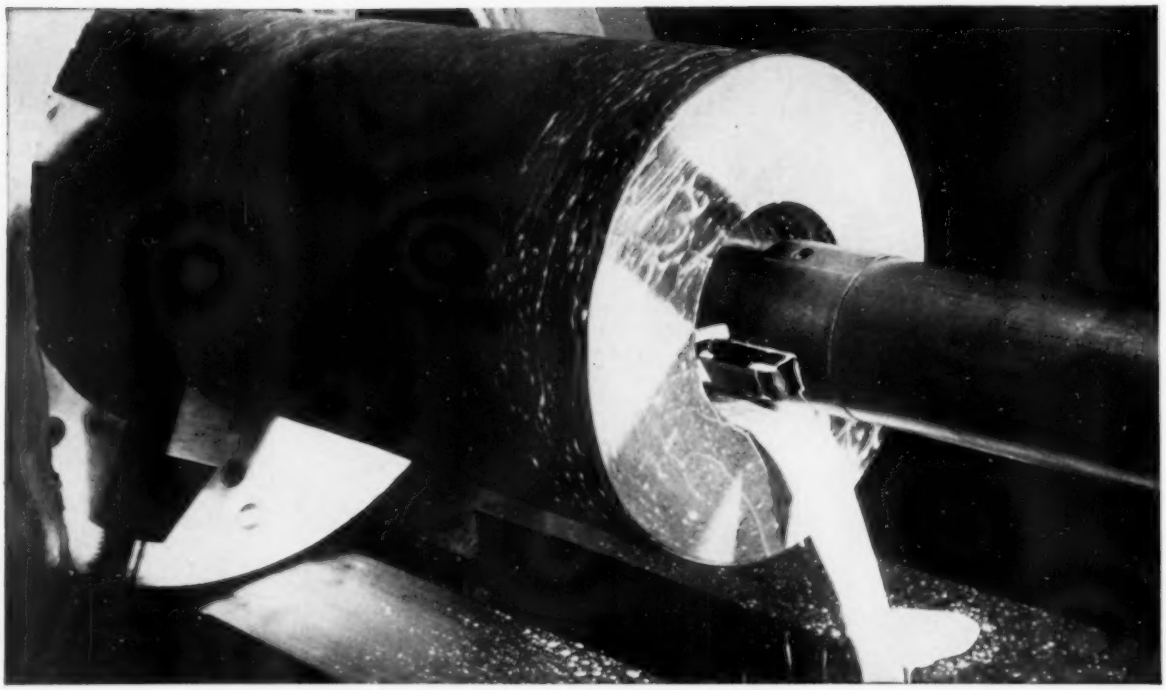
MACHINE TOOL ACCESSORIES • PRECISION TOOLS • HYDRAULICS • CUTTERS

millionths for missiles

With the CEDA SIZE equipped B&S No. 5 Plain Grinding Machine, diameter readings are transmitted to Amplifier from Electronic Caliper Gage riding on work. When diameter is within about fifty millionths of finished size, CEDA SIZE lever is depressed, which produces and controls an extremely fine grinding feed. When Amplifier indicator reaches zero, the specified size has been duplicated to ±0.000010" or less.

The ELECTROMATE Computer-Selector attachment, when used with CEDA SIZE, automatically computes the differential between the internal diameter of the mating sleeve (set on Electronic Bore Gage) and the external diameter of the part being ground. When indicator reaches zero, clearance (preset with masters) has been duplicated to ±0.000020" or less.

In addition to CEDA SIZE and ELECTROMATE the No. 5 Plain Grinding Machine shown is also fitted with ELECTRALIGN (upper rear amplifier) to insure easy, accurate control of taper.



Finish boring is your first step with Timken® seamless steel tubing —the hole's already there!

YOU save time and money when you make hollow parts with Timken® seamless steel tubing instead of bar stock. You eliminate drilling because the hole's already there. Finish boring is your first production step. With less metal to machine away you get more parts per ton of steel.

And because Timken seamless steel tubing eliminates one boring operation, your screw machine stations are free for other jobs. You get more machining capacity without adding machines.

And you get a better quality finished product with Timken seamless steel tubing because of the way we make it. A solid round is forged over a mandrel, thoroughly working the metal inside and out. This rotary piercing operation gives Timken seamless steel tubing its fine forged quality, uniform spiral grain flow. With exacting control of temperature and piercing speed, we maintain this quality from tube to tube, heat to heat, order to order.

And to further increase your steel savings, Timken Company engineers will be glad to recommend the most economical tube size for your hollow parts job. You'll get a size guaranteed to clean up to your dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

Save now by replacing your old arbors and quick-change chucks under the new Scully-Jones "Tool Modernization Plan"

If you have several arbors with bowed shafts and the threads just about gone, and quick-change collets that should be replaced soon, then now is the time to save!

The new Scully-Jones "Tool Modernization Plan" makes it imperative that you replace these cost-eaters *now*, and helps you take advantage of the latest tooling improvements described below.

New Blue-Band Milling Arbors give you more accuracy for the money, more strength per inch

Every Scully-Jones Blue-Band Milling Arbor has a larger end bearing and oversized end collar to assure a perfect fit and prevent runout. This means each tooth in the cutter will take its share of the load. There's no "pounding" or vibration to destroy surface finish. You get longer tool life because wear is evenly distributed over the teeth.

But perhaps your biggest gain will be on the investment that really counts: your milling machines. The faster you can make setups and the truer your cutters run after sharpening, the lower will be your tool replacement costs. And, the more evenly wear is distributed, the less stock to remove when sharpening, and the lower your tool replacement costs.

It makes sense, doesn't it, that with lower tool costs you can afford to operate cutters faster—step up your feeds and speeds for higher production, and at the same time enjoy longer running time on the machine tools that are so vital to profits?

Blue Band means blue chips!

Scully-Jones has "beefed up" the fillet at the sharp corner between the arbor shoulder and shaft.

This was possible because of the larger end collar, which has a generous 45 deg. chamfer to clear the fillet. Thus, you get the strength advantage gained by the original shaping of grain structure through forging, with less possibility of breakage under heavy cuts.

Here is another chance to capture the real profit potential of your machines by increasing rigidity. Tool life will increase, finish will improve, and you don't have to slow down to "baby" low-cost perishable tools ■

Fig. 1—Look for the Blue Band on the end collar of the next arbors you buy. Larger size makes it easier for operators to identify the end collar when setting up and gives you added assurance against high costs caused by cutter runout.

Safety-Guard Quick-Change Chuck prevents accidents and breakage on radial drills and drill presses

Here is an idea for your quick-change chucks that will give you added protection against accidents and tool breakage.

We have added a free-running, plastic "Safety-Guard" on the collet, with a lip to prevent heavy tools from slipping through the operator's fingers. The operator grips the guard, not the collet *or the cutting tool.* Thus, with a stub tool (Fig. 2), there is less danger of contacting sharp edges.

Answers critical need at high spindle speed!

When speeds are high on radial drills, think of what it means to have a free-running "bearing" between your hand and the collet.

There's no friction or heat during that split second before torque from the chuck is released. When inserting a new tool, the collet picks up speed from the spindle quickly, but gradually, giving the drive balls a better chance to seat themselves. The margin for error is reduced. And so is the possibility of breaking costly cutting tools because it's easy, not hard, for operators to handle heavy, sharp cutting tools efficiently ■

Fig. 2—Operator just cups his fingers and lifts up against the lip of the plastic Safety-Guard.

Limited Time Offer

Ask your Scully-Jones representative or distributor about the new "Tool Modernization Plan" under which you can co-ordinate replacement of obsolete milling arbors and quick-change chucks at a saving. Check your requirements, and act now.

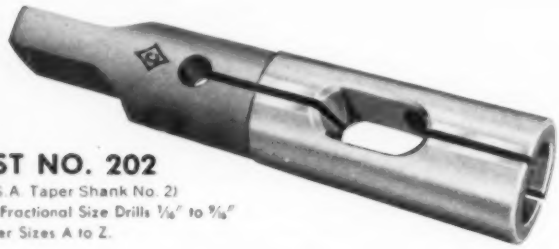
SCULLY JONES

SCULLY-JONES and COMPANY
1915 S. Rockwell St., Chicago 8, Ill.
Phone Bishop 7-5900

NEW CLEVELAND SPLIT SLEEVES . .

Greater concentricity between hole and body of this high quality sleeve assures longer tool life and more accurate drilling

LIST NO. 201
(A.S.A. Taper Shank No. 1)
For Fractional Size Drills 1/16" to 3/8"
Wire Gauge No. 1 to No. 52
Letter Sizes A to U.



LIST NO. 202
(A.S.A. Taper Shank No. 2)
For Fractional Size Drills 1/16" to 9/16"
Letter Sizes A to Z.

LIST NO. 203
(A.S.A. Taper Shank No. 3)
For Fractional Size Drills 23/64" to 3/4".

LIST NO. 204
(A.S.A. Taper Shank No. 4)
For Fractional Size Drills 37/64" to 1".

These new and improved Split Sleeves for straight shank tanged drills are made with precision holes, accurately air gaged for size and roundness to maintain extreme accuracy.

Modern manufacturing methods assure a high degree of concentricity between the hole and the body of the sleeve. There is less run-out at the drill point, resulting in longer tool life and better holes.

They are properly heat treated to resist distortion, mutilation and wear, and at the same time to provide the proper spring action for easy drill release and removal.

CLEVELAND Split Sleeves are designed and produced to the same high standards which have made the familiar ◈ trademark famous for quality since 1876.

Telephone Your Industrial Supply Distributor

Now your CLEVELAND Distributor can give you good service on CLEVELAND Split Sleeves. Be sure to order CLEVELAND Split Sleeves the next time you buy tanged straight shank drills!

. CUT YOUR DRILLING COSTS 2 WAYS!

CLEVELAND Split Sleeves, used with these Tanged Straight Shank CLE-FORGE Drills, give you greater economy

CLE-FORGE High Speed Drills have long been recognized for giving *more holes per grind.* Now, with the new CLEVELAND Split Sleeve, you can more effectively use tanged straight shank CLE-FORGE Drills *and get more flute length at lower cost.*

Instead of paying for a taper shank on every drill, you get the needed length with a split sleeve—which outlasts many drills.

On many jobs requiring extra length drills, the combination of CLEVELAND Split Sleeves and CLE-FORGE Taper Length Drills eliminates the need for special tools.

LIST NO. 915
Fraction Sizes
1/16" to 1/2"
Wire Gauge Sizes
No. 1 to No. 52
Letter Sizes A to Z

LIST NO. 916
Fraction Sizes
33/64" to 11/16"

LIST NO. 949
Fraction Sizes
1/8" to 11/16"

LIST NO. 950-K
Heavy Duty Drill
Fraction Sizes
1/8" to 1 1/4"

Below are shown seven types of Special Purpose Straight Shank CLE-FORGE High Speed Drills. These drills are not regularly available with taper shanks, but they can be furnished with tangs (at no extra cost) and used with CLEVELAND Split Sleeves.

Taper Length Regular Milling

Drills for Plastics

Taper Length Heavy Duty Hy-Spiral

Hy-Spiral or High Helix Drills

Low Helix or Drills for Brass

Heavy Duty or Cotter Pin Drills

Jobbers Length Cobalt Drills

THE CLEVELAND TWIST DRILL CO.

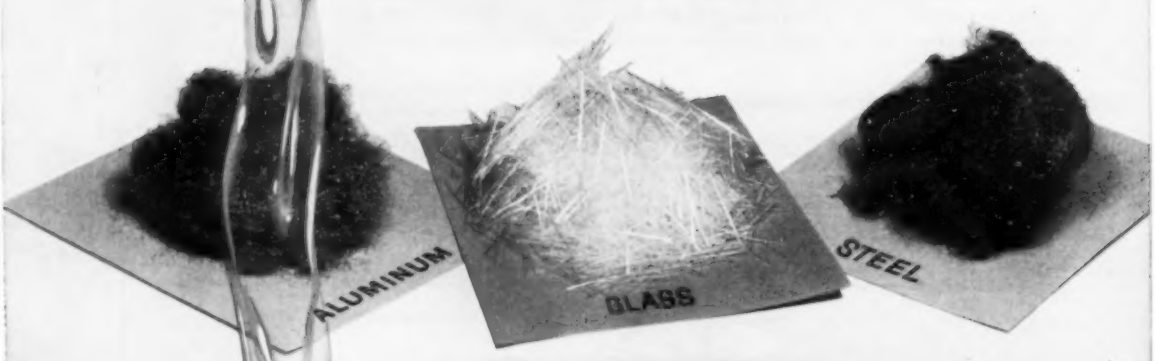
1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

BAKELITE
EPOXY

INVESTIGATE THE MANY ADVANTAGES OF...

NEW EPOXY-



Fibers of glass, steel, or aluminum are combined with resin systems based on BAKELITE Brand Epoxy Resins to produce new Epoxy-Alloy for medium production runs.

DEVELOPED BY BAKELITE COMPANY, EPOXY-ALLOY NOW BRINGS PLASTIC TOOLING ECONOMIES TO MEDIUM-RUN PRODUCTION

This new development extends the advantages of present plastic tooling materials—materials that provide the tool and die industry with

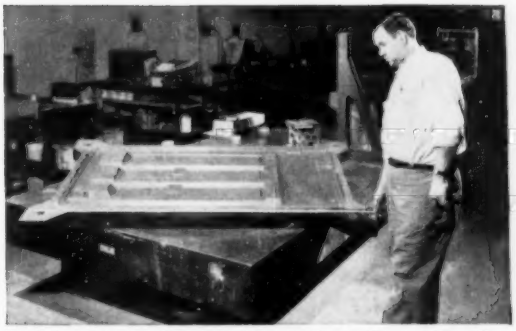
- **lower costs**
- **lighter weight**
- **shorter tooling-up time**

What is Epoxy-Alloy? New formulations based on BAKELITE Epoxy Resins—combined with glass or metal fibers for greatly increased strength, thermal conductivity, and machineability:

What does it do? Epoxy-Alloy provides metal-forming plastic tools with up to 60 times greater thermal conductivity than present epoxy tooling compounds—equal to some grades of stainless steel . . . lower exotherm in casting large sizes and complex shapes . . . high heat resistance, impact strength, and rigidity . . . dies that are easily machined, modified, or magnetized.

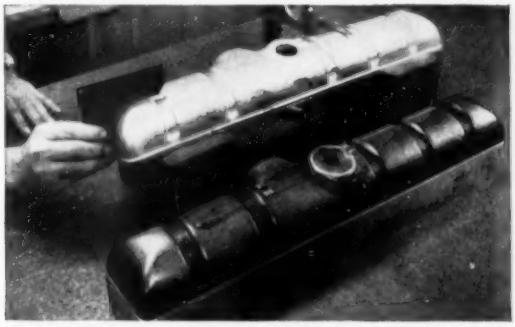
ALLOY

BAKELITE Brand Epoxy Resins used in these formulations are unsurpassed in quality . . . thoroughly tested in Bakelite Company laboratories and in actual product applications. For further information and names of Epoxy-Alloy Compound suppliers, mail the coupon today!



Heated matched molds are made from Epoxy-Alloy, which utilizes the high thermal conductivity of aluminum fibers. The cost is only half that of aluminum molds, or a third to a fifth that of machined steel molds. Delivered in four weeks.

65,000 steel panels—five weeks early. Estimated production time for these "all steel" draw dies was ten weeks. Using Epoxy-Alloy inserts cut delivery to five. They have since formed 65,000 refrigerator bottom panels of .036 cold-rolled steel without serious wear.



Over 130,000 radiator tank tops were stamped out by this die made from Epoxy-Alloy, operating for more than a year without repair or maintenance. Metal was .025 in. brass. Estimated cost: *40 per cent less than for an all-metal die.*

It pays to formulate with

BAKELITE BRAND **PLASTICS**

UNION CARBIDE

Bakelite Company, Dept. CG-181
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

Please send me your booklet describing the new Epoxy-Alloy.

Name_____

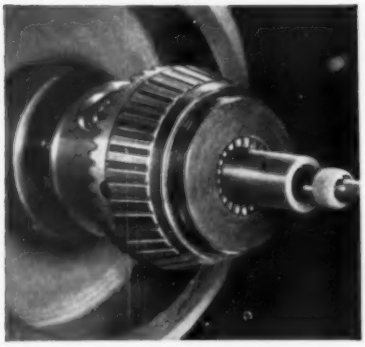
Firm name_____

Street_____ Zone____ State_____

BAKELITE COMPANY, *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.
The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.

Grinding a 4" spindle bushing within .0002" on both O.D. and I.D. at the Royal Typewriter Co.

"This Jacobs Chuck has been in constant use for 4 years without repair or replacement"



This spindle bushing, ground to a tolerance of .0002" I.D. and O.D., will be used in a grinding head to grind typewriter escapement wheels. Exacting accuracy is essential.

Mr. Barclay Craigie grinds pieces with O.D. from 1/16" to 1 3/8" on a Brown and Sharpe No. 4 Universal Grinding Machine equipped with a Jacobs Key Type Rubber-Flex Collet Chuck. He is often required to maintain tolerances like the .0002" demanded inside and outside on this bushing. He says:

"I get all the accuracy I need. This chuck is a big timesaver—better for the operator and for the company. I have used it continually for 4 years without repair or replacement of collet."

You hold your work with the tightest, most accurate grip ever devised when you hold with the Jacobs Rubber-Flex Collet. Ask your industrial supply distributor for Bulletin 57-CC on the Model 96 Key Type Collet Chuck shown here and for Bulletin 57-LC on the Model 91 Hand Wheel Collet Chuck.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

Jacobs CHUCKS

The Jacobs Manufacturing Company, West Hartford, Connecticut

OK multi-operation tools— more beef in the body

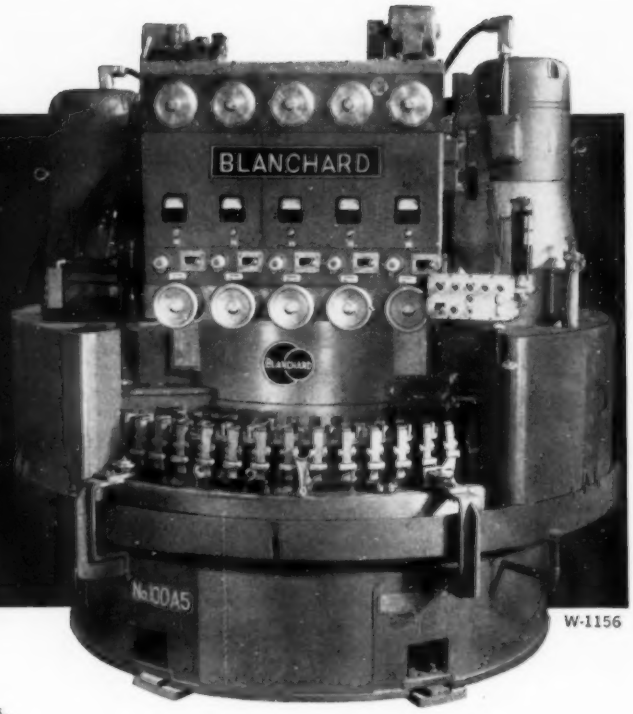
One man,
one machine,
one pass,
now does the work of six
A winning combination to reduce costs . . .
OK modern milling cutters
mounted on modern milling machines

OK

THE OK TOOL COMPANY, INC.
300 Elm Street
Milford, New Hampshire

FREE: FIFTY PAGES OF NEW ENGINEERING PRINTS SHOWING ADVANCE IDEAS IN MULTIPLAM, ONE PASS TOOLS FOR BORING, MILLING AND REAMING OPERATIONS.

For mass production grinding at lowest unit cost... Blanchard Center Column Surface Grinders



W-1156

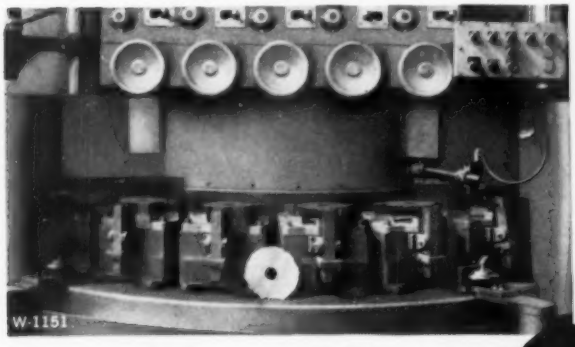
For long-run work at high production rates, it's just plain good economic sense to grind flat surfaces on the Blanchard. These automatic multiple-spindle machines are widely used in the cost-conscious automotive industry for close-tolerance grinding from the rough castings or forgings. Time-saving Blanchard fixtures allow a single operator to handle large quantities of parts every shift.

Blanchard Center Column Grinders are available with three, four or five grinding spindles and 80", 90" or 100" O. D. work tables to handle a wide variety of parts. The No. 100-A5 is shown.

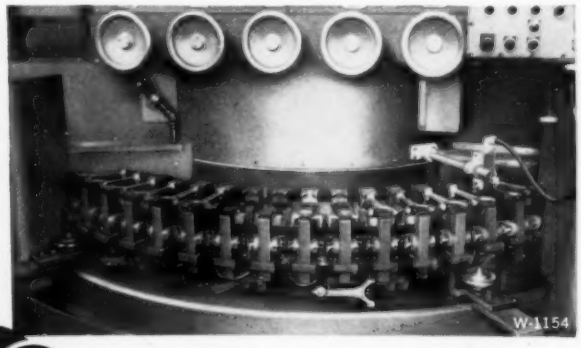
New functional design, with minimum floor space, provides several advantageous features. Sludge disposal is automatic to coolant reservoir . . . power rapid traverse on each head speeds wheel changes. Wheels are easily reached through separate doors from the floor. Centralized lubrication . . . all operating controls are easily accessible, with complete safety features for operator and machine protection . . . large loading-unloading area. These and other features result in better grinding jobs in less time—*and at less cost*—when you Put It On The Blanchard.

Send for illustrated folder No. 374 which describes the 3 models of the Center Column machines in detail.

Typical Grinding Jobs Performed on the Blanchard Center Column Grinder:


W-1151

Front Pump Cover. MATERIAL: Cast Iron. STOCK PER SIDE: 1/16" to 3/32". NO. OF SIDES GROUND: One. LIMITS: Must be flat within .002". PRODUCTION: 360 pieces per hour (net). These pieces are ground in a 20 station fixture, on a No. 100-A5 Blanchard.


W-1154

Connecting Rods. MATERIAL: Steel forging. STOCK PER SIDE: 1/32". 1st OPERATION: Grind 2 sides and 2 ends. LIMITS: ±.001". NO. OF SIDES: 2. PRODUCTION: 600 per hour, 1200 surfaces (net). These pieces are ground in a 60 station fixture, on a No. 100-A5 Blanchard.

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

The brazing operation is most critical in the manufacture of carbide tipped tools. Clean, true recesses, proper amount of bonding alloy, exact placement of tips, correct application of heat and pressure, all are essential to a perfect bond.

His work is as good as his bond

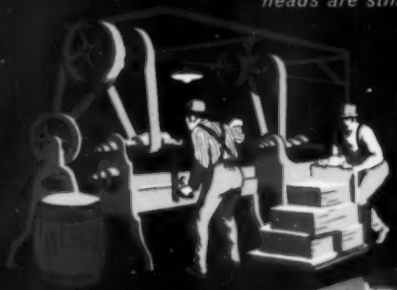
At Greenfield, close adherence to these manufacturing standards, careful selection of materials plus close supervision and inspection, assure a quality bond. Yes, this craftsman's work is as good as his bond.

GREENFIELD TAP & DIE

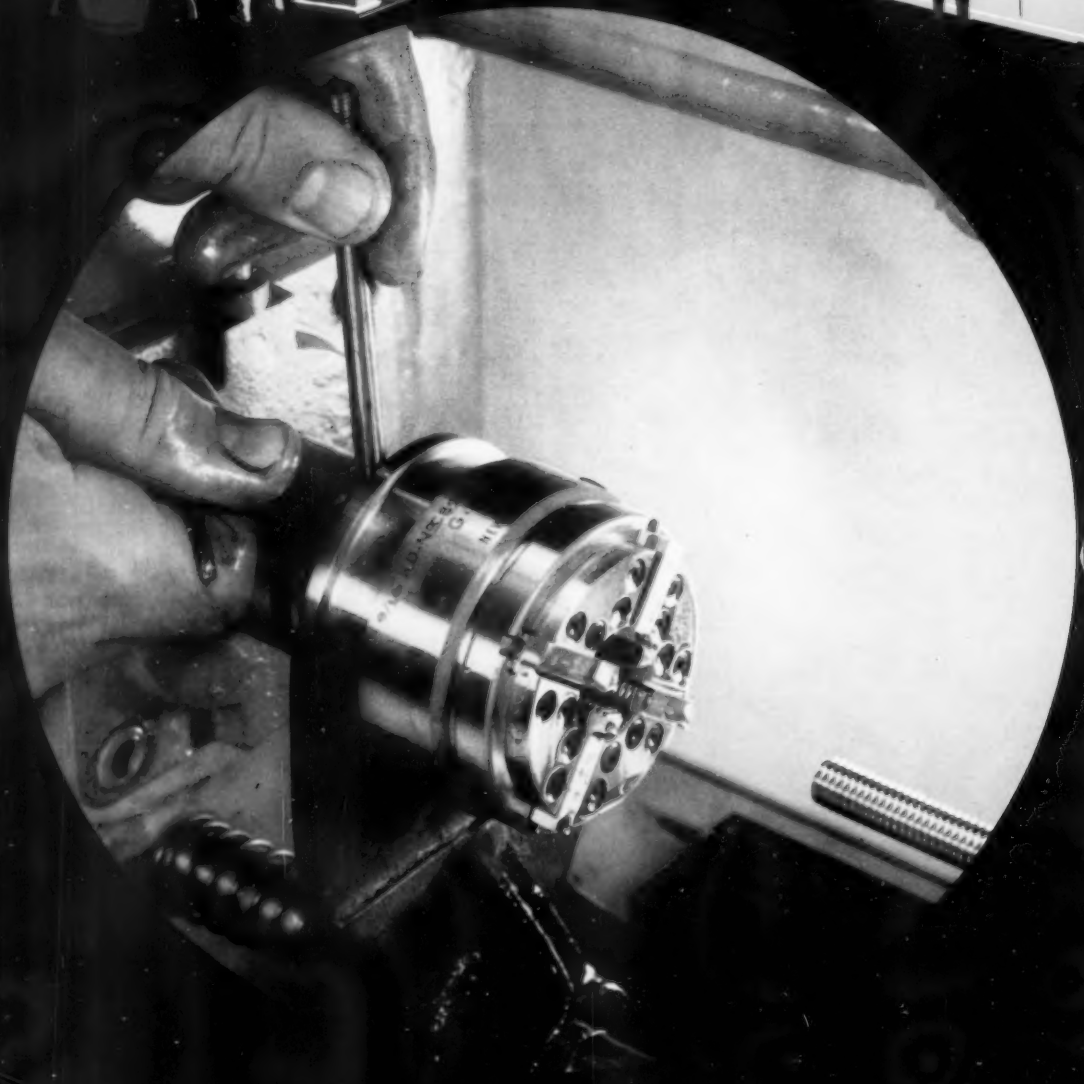
GREENFIELD, MASSACHUSETTS

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

GEOMETRIC Die Heads were born in a plant like this, and some of those ancient heads are still operational.



But with this streamlined Giant? We're sorry – you can still find some worn out or pretty old die heads even in them!



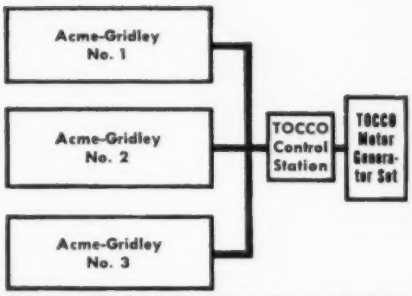
GEOMETRIC

You may "get by" with antique or worn out tooling, but you won't get ahead. Don't hold down those new, expensive automatics with out-of-date or worn die heads. A machine tool is only as good as its cutting tools. Give it a break. Give it a NEW GEOMETRIC.

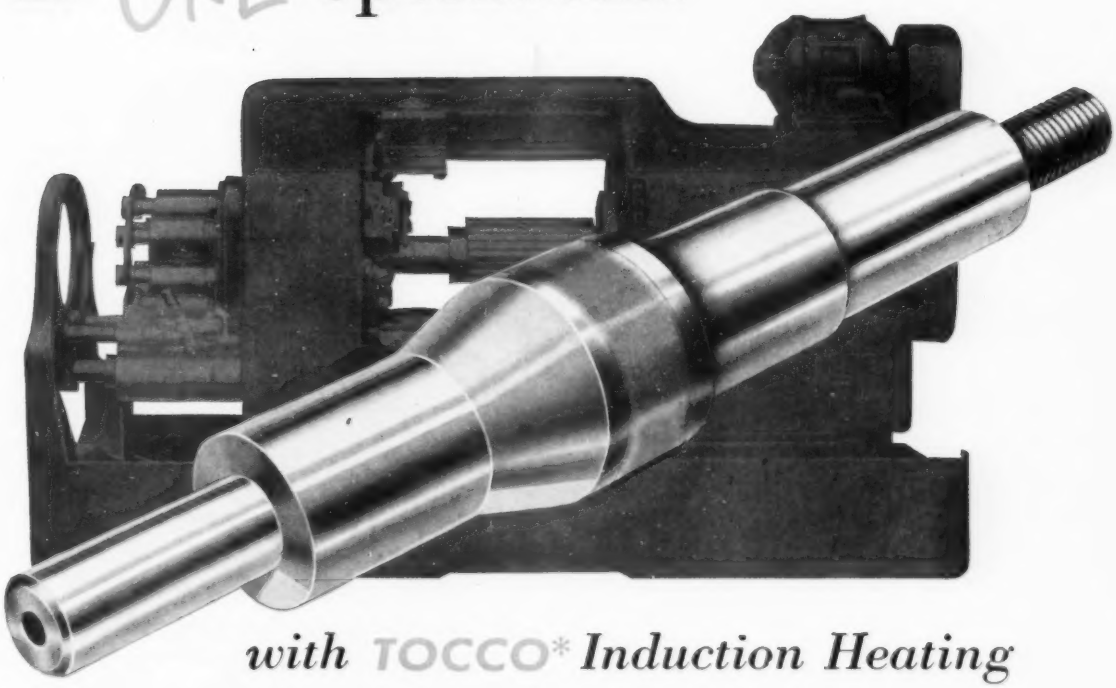
CALL YOUR GEOMETRIC DISTRIBUTOR TODAY

GEOMETRIC – HORTON NEW HAVEN 15, CONNECTICUT

Pump Shafts Machined and Hardened in ONE operation...



Plan view of TOCCO-equipped automatic screw machine installation for hardening collars on vane pump shafts.



with TOCCO Induction Heating*

TOCCO-equipped 8-spindle Acme-Gridley Screw Machines at a large automotive manufacturer's plant produce vane pump shafts for power steering units in one completely automatic operation! The hardening and metal-working operations are combined on the same machine.* No additional handling—no hardening cost except power!

A TOCCO inductor, mounted at one station of each automatic, hardens collars on pump shafts after they have been completely machined at preceding stations on the same machine. Each installation consists of 3 automatic machines equipped with inductor coils powered by a 50 KW, 10,000 cycle TOCCO unit. Production from each installation is 360 shafts per hr.

Shafts are made of C 1144 and only the collar is hardened to prevent scoring the seal. TOCCO's rapid heating confines the hardened area to the surface of the collar leaving the rest of the shaft unaffected.

If your products or their components require heat treating, soldering, brazing or heating for forging, it will pay you to investigate TOCCO for better, faster production at lower unit costs.

*A Patented Process

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. G-5, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

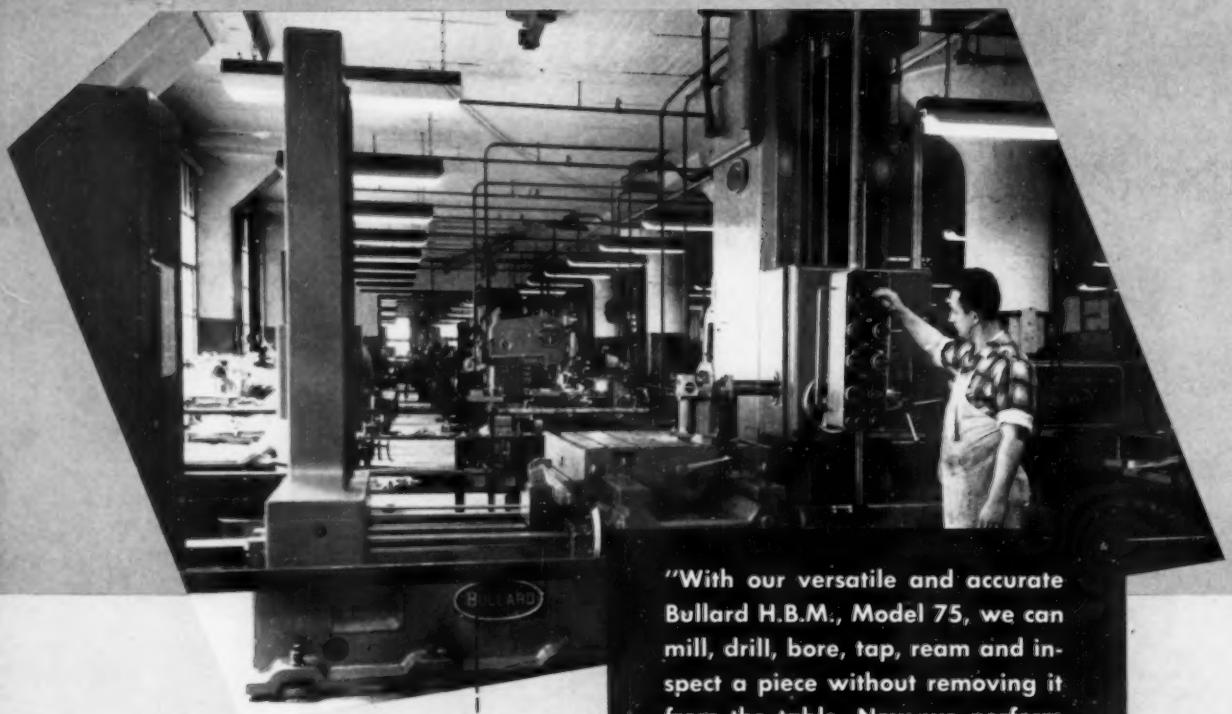
Company_____

Address_____

City_____ Zone____ State_____

PROFIT DEVELOPMENT ...is important!

"We discovered," reports the Mergenthaler Linotype Co., "that a Bullard H.B.M., Model 75 saves us valuable time. It eliminates much of the waiting and handling time previously used in the fabrication of jigs, fixtures and special parts."



"With our versatile and accurate Bullard H.B.M., Model 75, we can mill, drill, bore, tap, ream and inspect a piece without removing it from the table. Now we perform as many operations as possible on the same machine."

The Dav-a-matic, world's first automatic, all-purpose offset duplicator, is produced by Mergenthaler Linotype Co. with the help of its 3" Bullard H.B.M., Model 75.

BULLARD

Investigate

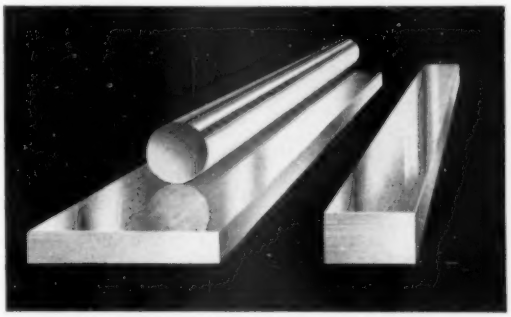
How modern Bullard Machine Tools can improve your profits

Remember . . . to cut costs when cutting metal — buy Bullard

Phone or write your nearest Bullard Sales Office, Distributor or

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT



Prefinished tool steels of *quality*

FOR TOOLS, DIES, AND PRECISION PARTS

PRECISION GROUND
OIL HARDENING NON-WARPING TOOL STEEL

Warplis
FLAT STOCK
FLATS & SQUARES

OIL HARDENING
NON-WARPING

Warplis
DRILL RODS
ROUNDS

. . . these companion products come in hundreds of sizes, available from selected distributors coast-to-coast. Descriptive price lists on request.

High standards of production assure flawlessly finished, perfectly dimensioned steel, all ready for the talents of the tool and die and parts maker. The composition (01) is generally regarded as the finest of its type—safe hardening . . . versatile of application . . . tops in performance at the working point.

PITTSBURGH TOOL STEEL WIRE COMPANY

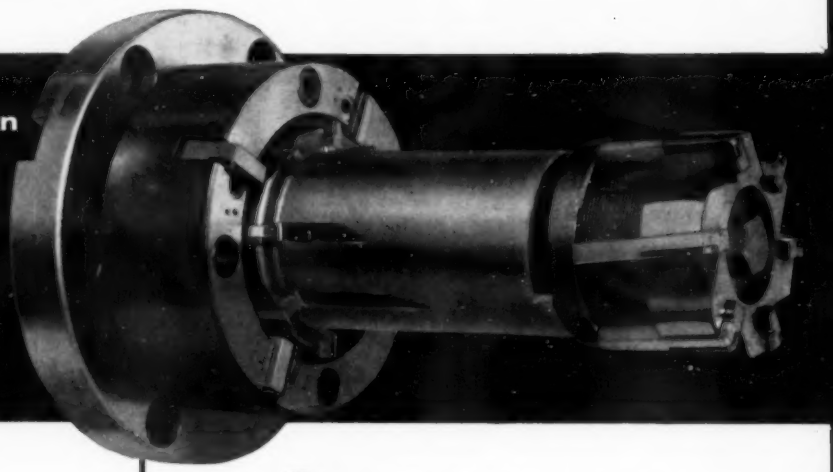
Specialists in cold finished fine steels since 1902

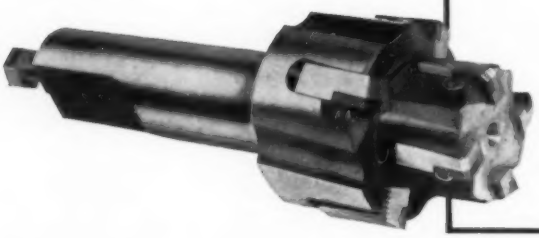
MONACA, PENNSYLVANIA

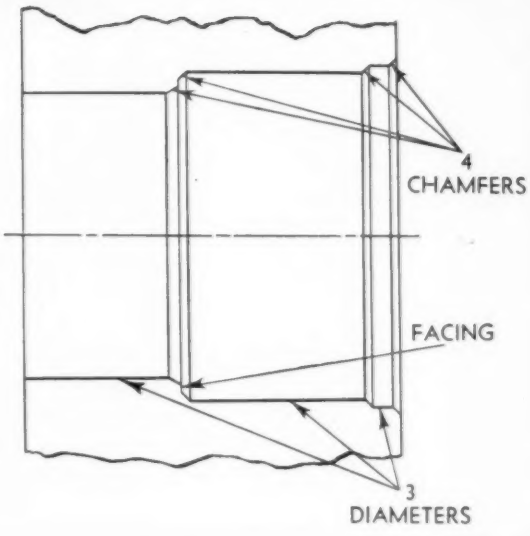
for high-production,
transfer-type machining...

Barber-Colman

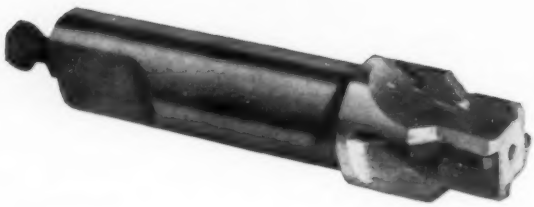
MULT-O TOOLS SAVE TOOLING COSTS!





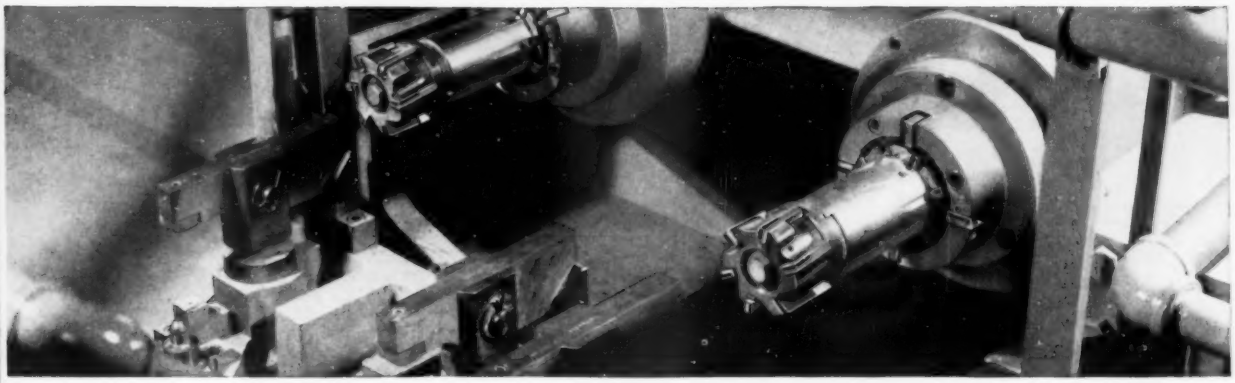


Eight surfaces cut by one MULT-O Tool



VISIT OUR BOOTH
'58
ASTE TOOL SHOW

SEE THEM ON DISPLAY . . . BOOTH NO. 1255



These Barber-Colman Mult-O Tools perform 34 machining operations on power steering housings which are processed on a 35-station Greenlee transfer machine. A total of nineteen tools ranging from .220" to 6.250" diameter combine multiple operations for facing, hollow milling, boring, reaming and chamfering.

In most cases, one tool performs several operations. The sample drawing shows the eight surfaces which are cut by one tool. There are four chamfering operations, one facing operation, and the tool reams three different diameters. All tools are designed to perform a maximum number of operations. This combination of operations results in a minimum number of spindles.

Most cutting edges are carbide tipped inserted blades. Carbide tips provide long tool life, and the inserted blades result in low tool cost since only the blades require replacement. Wherever possible, standard blades are used so that they can be obtained from stock. Conventional sharpening methods are used on all tools.

In designing high-production Mult-O Tools of this type, Barber-Colman Engineers consider chip load, finish required, and amount of stock to be removed for determining the number of blades in each tool. Holding means and type of blade mounting are designed to suit each particular application and size of tool.

On this job, machine designers supplied part prints, sequence of operations and production requirements. With this data, Barber-Colman Cutter Engineers designed tools to combine multiple operations for the most efficient results.

Mult-O Tools can also offer cost saving advantages for *your* production operations. If you use multiple operation, transfer-type machining in production, ask Barber-Colman Engineers for analysis and recommendations on cutting tools which produce maximum efficiency. Send part prints and production desired. A representative will be glad to discuss your requirements on request.

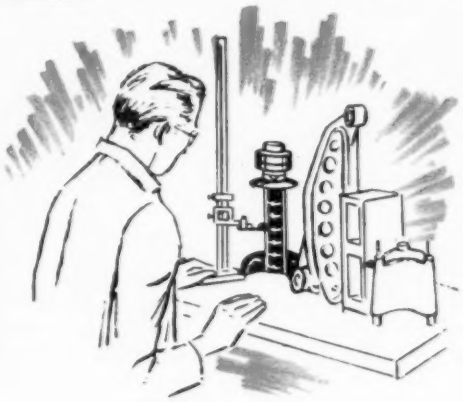
BARBER-COLMAN COMPANY

885 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

This Cadillac 6" PLA-CHEK GAGE *IS ACCURATE* to .00005"



Cadillac PLA-CHEK

For checking smaller jobs, gages, tools and dies, this portable 6" Cadillac PLA-CHEK Gage is accurate to .00005". It can easily be checked in and out of your tool crib to be used on the surface plate or at the machine. It is completely self-contained and extremely simple in operation. Speeds inspections from minutes to seconds.

Capacity of the 6" PLA-CHEK model can be increased by the addition of a 6" riser without affecting accuracy or sacrificing portability. Send coupon TODAY for complete details!

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Cadillac GAGE COMPANY
P. O. BOX 3806 • DETROIT 5, MICH.

the leader adds an

SO...CARBORUNDUM HAS ADDED AN "M"...MAN-MADE DIAMONDS

When you see an "M" prefix on a Diamond Wheel by CARBORUNDUM, you'll know the diamonds are Man-Made. We have been hard at work for two years perfecting their application. We know what they can do. You owe it to yourself to find out. TEAR OUT and mail the COUPON. Do it TODAY!

THE CARBORUNDUM COMPANY is proud to announce the addition of MAN-MADE industrial diamonds to its already outstanding line of Diamond Wheels. For many years CARBORUNDUM has been recognized as the leader in the development and manufacture of Diamond Wheels and Hones. Constant close liaison with world-wide diamond markets and vigilant exhaustive research and development have kept the CARBORUNDUM line out in front. Due to very recent developments by American industry and science, no line of industrial products is now complete without MAN-MADE diamonds.

THE CARBORUNDUM COMPANY, Dept. "M"
P. O. Box 403, Niagara Falls, New York

Name _____

Company _____

City _____ State _____

Ask the man from

CARBORUNDUM

REGISTERED TRADE MARK

2,000,000 DEFLECTIONS WITHOUT FAILURE.....Severe

fatigue tests show Duraflex,® Anaconda superfine-grain Phosphor Bronze, permits far higher design stress

Licensed
Professional Engineers, Members
American Society for Testing Materials
American Society of Mechanical Engineers
National Society of Professional Engineers

CONSULTING ENGINEERS
THE CARLSON COMPANY
MACHINE DESIGNERS

3457 WEIDNER AVE.
OCEANSIDE, L. I., N. Y.
TELEPHONE: RO 4-8181

Complete engineering and manufacturing service including design and development of special machinery, mechanical products and spring actuated mechanisms. Stress analysis, spring design, metallurgical data, heat treatment, sheet layout, engineering reports, selection of materials and equipment. Tools and products.

The American Brass Company,
99 Park Avenue,
New York 16, New York.

October 25, 1957.

Gentlemen, SUMMARY OF ENGINEERING LABORATORY REPORT NO. 102557

SUBJECT: Fatigue Life Test of "Duraflex", Superfine-Grain Phosphor Bronze and Commercial Quality Grade A Phosphor Bronze spring wire.

SPECIMENS: Compression springs made from each material, were coiled on arbors to avoid tool marks. The springs had squared ends, a high pitch to obtain high stresses and were heated after coiling in boiling water for 1 hour to relieve residual coiling stresses.

CALIBRATIONS: Each spring had its physical dimensions measured with micrometers and vernier calipers and was load tested in a Comaco Elasticometer Precision Spring Testing Instrument, before fatigue testing and after each 100,000 cycles of deflection to determine loss of load, if any.

FATIGUE TESTING: A representative number of springs from each material were tested simultaneously under identical conditions.

STRESSES: The stress in the springs, including curvature correction, during the tests were as follows:

Stress at Initial Installed Position	36,600 p.s.i.
Stress at Final Deflected Position	73,200 p.s.i.
Stress Range during deflection	36,600 p.s.i.

These stresses, for endurance limit testing, are exceptionally high for phosphor bronze spring wire - far higher than those ordinarily recommended for Beryllium-Copper or Stainless Steel for such severe service and are comparable to those used for good quality Spring Steel.

RESULTS: Grade A Springs broke at average deflections of 505,700.

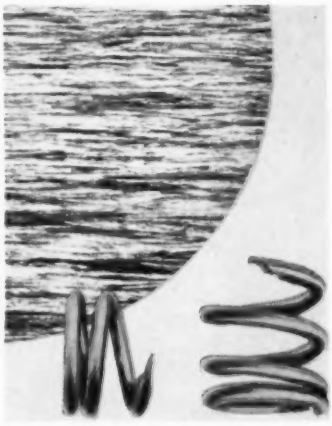
Duraflex Springs were still satisfactory with no appreciable loss of load at 2,000,000 deflections.

CONCLUSIONS: 1. Design stresses for Duraflex can be at least 33% higher than those used for Grade A Phosphor Bronze and as high if not higher than design stresses recommended for Beryllium Copper.

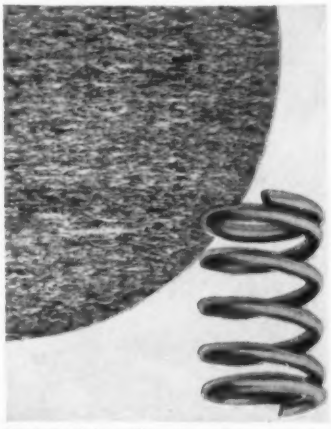
2. High endurance and long fatigue life at high stresses can be expected from springs made of Duraflex Phosphor Bronze.

CERTIFICATION: We certify the above summary of our report is accurate, in accordance with the facts and is true in every respect.

Respectfully submitted,
THE CARLSON COMPANY
Harold C. H. Carlson
Harold C. H. Carlson, P.E.
Licensed Professional Engineer.



Spring of Alloy A Phosphor Bronze, shown actual size, which broke just after 500,000 deflections. Micrograph (75x) shows typical grain structure of this metal.



Spring of Duraflex showed no appreciable loss of load after 2,000,000 deflections in same test. Micrograph (75x) shows typical superfine-grain structure of Duraflex.

Duraflex is a registered trade-mark for a higher quality phosphor bronze in sheet and wire forms, recently developed by American Brass Company research. Yet it costs no more than regular phosphor bronze. For detailed information—for a copy of the test data—write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

DURAFLEX

Superfine-Grain Phosphor Bronze

A product of

ANACONDA®

Made by The American Brass Company

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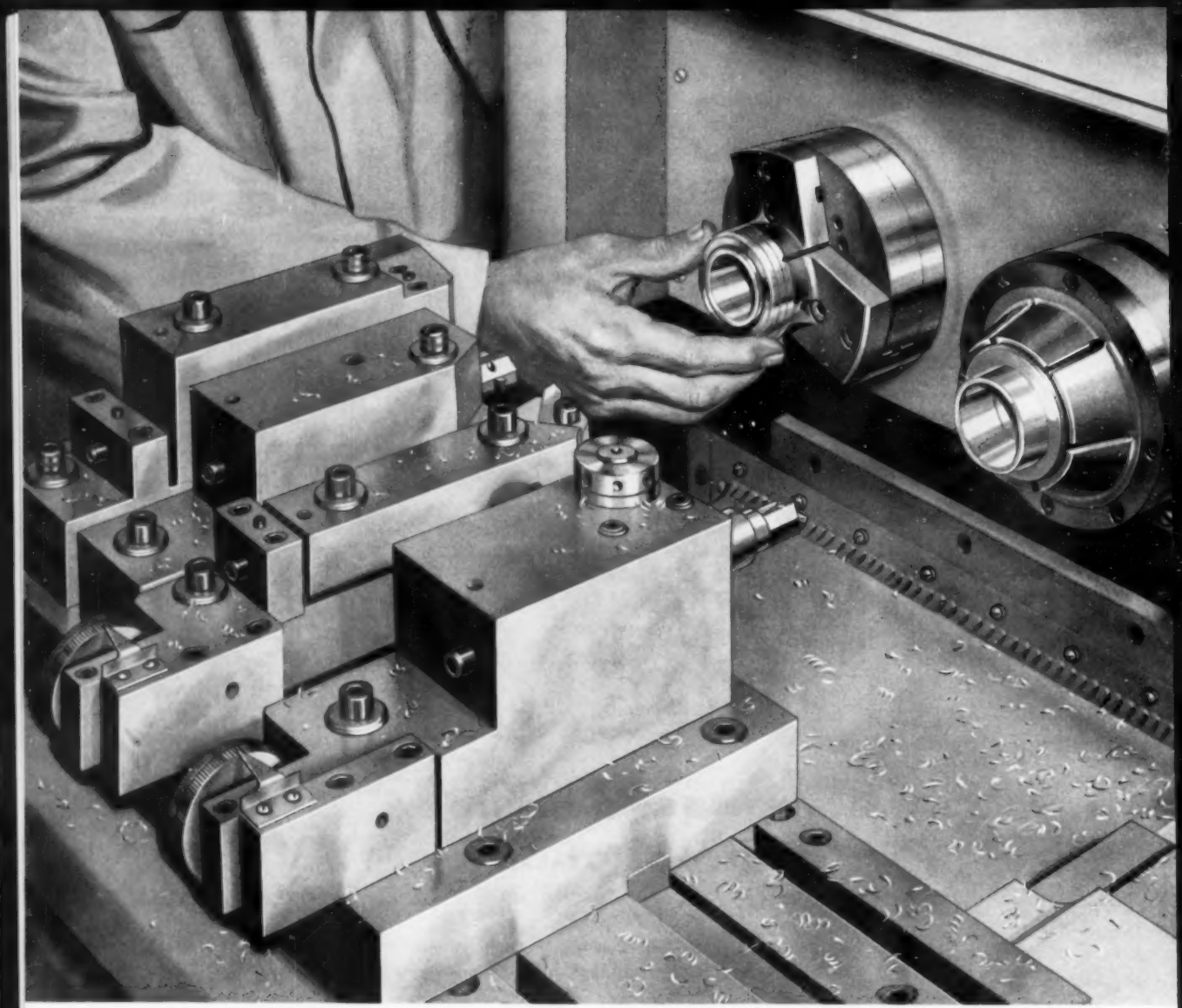

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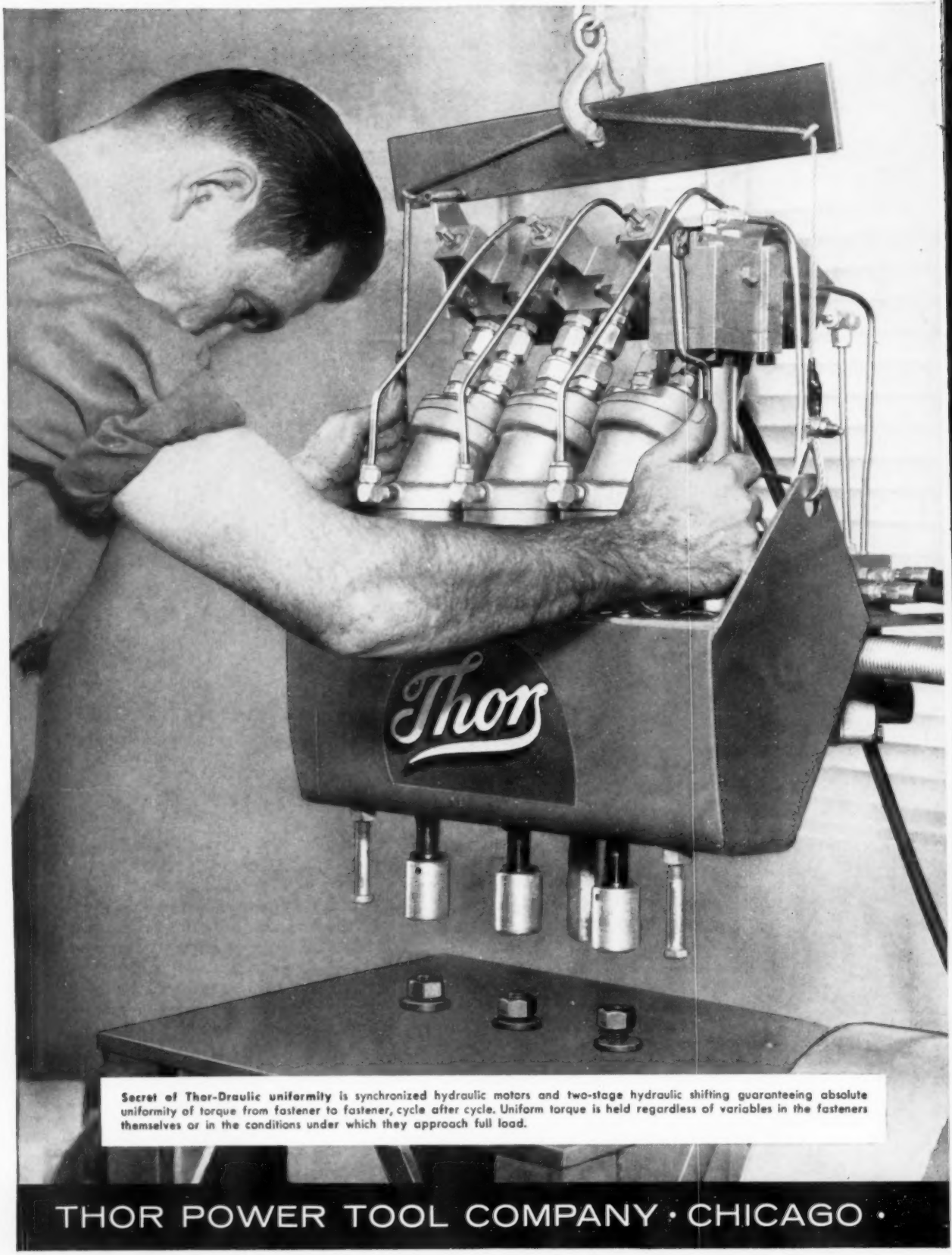

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Leading the Way

The American Society of Tool Engineers has only one real objective—to lead the way toward continually greater productivity and a continually better standard of living for everyone.

Having accepted the challenge of leadership, your Society is training its present and future leaders.

The Leadership Conference to be held in Philadelphia on May 5 and 6 is one of the most important investments in the future that your Society has ever made.

Here chapter leaders—who are in charge of chapters that have from 75 to over 2000 members—will be trained in effective management techniques. This will enable them to lead their chapters to new peaks of achievement during the coming year.

Also, since the chapter leaders of today are the national leaders of tomorrow, they are being familiarized with all national programs and services of ASTE and with Headquarters operations.

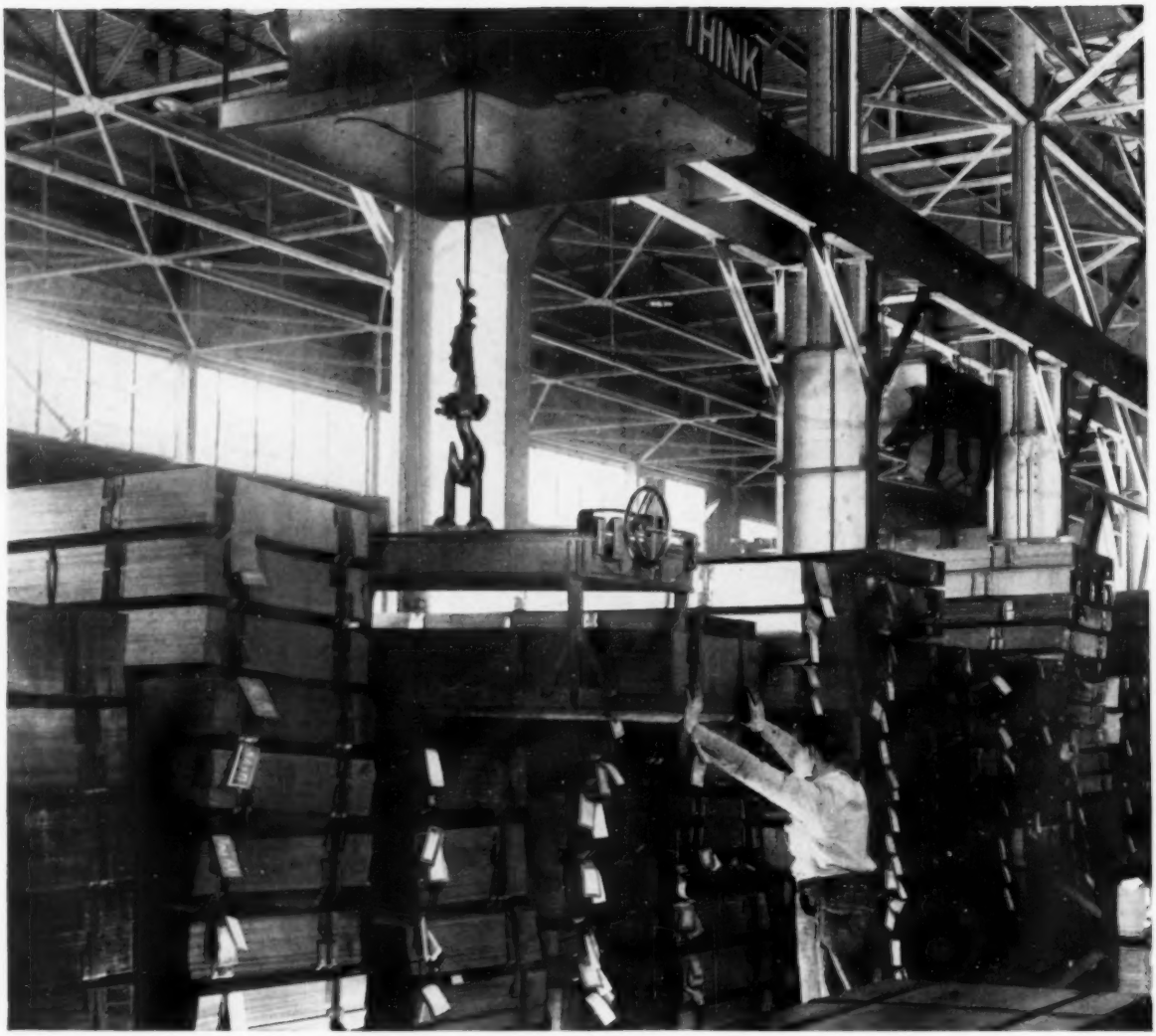
The purpose of all these activities is to carry out the broad objective established by Society members through their officers.

Establishing an objective is one thing; attaining it is another. The progress of the Society to date has been the result of the efforts of hundreds of dedicated individuals who have devoted their time and talents to leading the way.

With the stimulus furnished by the Leadership Conference, we can expect accelerated progress in the future.

H E Collins

PRESIDENT
American Society of Tool Engineers



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planning for Automation ...team approach pays off

By W. C. Allen*

Manufacturing Director
Headquarters Mfg. Dept.
Westinghouse Electric Corp.
Pittsburgh, Pa.

Successful automation programs at Westinghouse are the result of co-operation and long-range planning by sales, manufacturing and design engineering personnel. Their common objective is a salable product that can be manufactured at the lowest possible cost.

DURING THE NEXT FEW DECADES, the population of the United States will almost double. If the increase in consumer demand follows current trends, there will be a definite labor shortage during the same period. The number of persons from 25 to 45 years of age—the period of maximum productivity in the working life of the average person—will not increase as fast as the number of persons who are too young or too old to work. The only solution to this long-term labor shortage lies in increasing the productivity of available men and machines—in short, there must be greater mechanization and automation. The present trend toward automatic operations must be accelerated. At the same time, the economics of such operations should be kept in mind.

Teamwork Planning: At Westinghouse, the need for improved productivity has long been recognized. Many of the products of the company, such as electric motors, are incorporated in mechanized and automated equipment, and the company itself has used modern operations wherever possible.

This experience has shown that thorough planning is the key to success in manufacturing. Product planning is accomplished by a team composed of representatives from sales, design engineering and manufacturing. The objectives of this team are to plan salable products of accepted quality and to make sure that these products can be manufactured to sell at competitive prices.

Each of the members of the team is a highly qualified specialist in his own field. Of equal importance, however, is the fact that each team member is well-versed in the fields of basic organization, planning, coordination and management. Thus all team members have an understanding of the professional and technical problems confronting the others.

During the initial phases of product planning,

***Senior member ASTE Pittsburgh chapter. Mr. Allen is now associated with International Telephone and Telegraph Corp.**

Abstracted from Paper 117, "Automation—the Sales, Engineering, Manufacturing Triangle" to be presented at the 26th Annual Meeting. Copies of the complete paper will be available for purchase from Society headquarters.

team members consider, in a general way, a product that will fulfill customer needs and can be sold at a price that is satisfactory to the customer and profitable to the manufacturer. Once this preliminary planning has been done, the product is further analyzed to establish the potential volume, functional features and specific design.

As specific planning takes places, there is a meeting of the minds between all team members.

Successful manufacturing programs are the result of cooperation between product engineering, manufacturing and sales personnel at Westinghouse.

The team member representing sales recognizes that product features and performance may be subject to some compromise to keep manufacturing costs within an established percentage of sales price. Similarly, the engineering representative takes manufacturing requirements into consideration. Economic—as well as producibility—questions are taken into account by manufacturing.

Automation Planning: Economic questions are of particular importance when automation is being considered. Some typical questions are:

- What initial investment for tooling is involved?
- Is suitable manufacturing equipment available or can it be developed?
- How reliable will the equipment be?
- What savings will result?

The product design engineer is also a key figure in this phase of planning. In some cases, complete redesign of a product may be necessary before automation is feasible. This is particularly true in the case of automatic assembly operations, where problems of hopper feeding, brazing and joining can be better solved by product modifications than by designing elaborate assembly equipment or fixtures.

A second factor considered by the design engineer is standardization. Although automatic production is usually associated with high product volumes, there may be many high-volume items in a job shop operation. Electric motor rotor and stator laminations are a case in point. Relatively small quantities of laminations are required for each of a number of motor sizes. Such parts can be redesigned for high production by standardizing the laminations, obtaining higher motor horsepower by lengthening the stack.

Standardization of this type is an example of the benefits that can be obtained when there is complete understanding and cooperation between the man who designs a product and the man who plans the equipment, tooling, processes and methods to manufacture that product.

If the planning team agrees that automation is mechanically and economically feasible, preliminary equipment design is initiated. Several general guides have been developed by Westinghouse engineers to avoid pitfalls in design.

All production lines, for instance, are designed with due consideration for tool-change time, normal maintenance, load and unload cycles and other normal production interruptions. This minimizes the possibility of extensive down time that could result in cumulative production losses.

Flexibility is a primary consideration. Transfer lines constructed from standard modular machine units are preferred. These units can be rearranged as dictated by changing product designs. There is no possibility of a product design being "frozen" because of inflexible production equipment. When special operating functions are incorporated in the tool heads and fixtures, rather than in machines, product design changes cost less, standard machine repair parts are available and initial capital investment is lower.

Another advantage of modular construction is that the transfer line can be "backed up" with conventional equipment in case of serious failure. Entire sections of an integrated line can even be removed and replaced with standard machine units.

At Westinghouse, automatic production lines are designed for straight-line operation. "Carousel" machines become cumbersome as the number of operations is increased. There is, however, ample economic justification for some carousel machines. The motor frame machine at the Westinghouse Buffalo plant performs some operations at double the output of a comparable in-line machine, with less capital investment.

This points up the fact that each installation should be planned in detail only after many approaches have been studied. Usually, the planning team starts with the "ultimate"—that is, the line

Detailed product and volume forecasts by the sales department have a direct bearing on facilities and investment. They are the basis for planning.

is initially planned without regard to costs. Then, compromises are worked out so that the final equipment and tooling represents the best solution from an economic point of view.

Automation has been defined as "continuous automatic production." There must be provision for continuation of production in case of failure of intermediate work stations. Banks of partially finished parts at each station are one answer. Shuttle conveyors to normally idle standard machines are another form of insurance, as is the provision of "emergency" work stations as part of the integrated line.

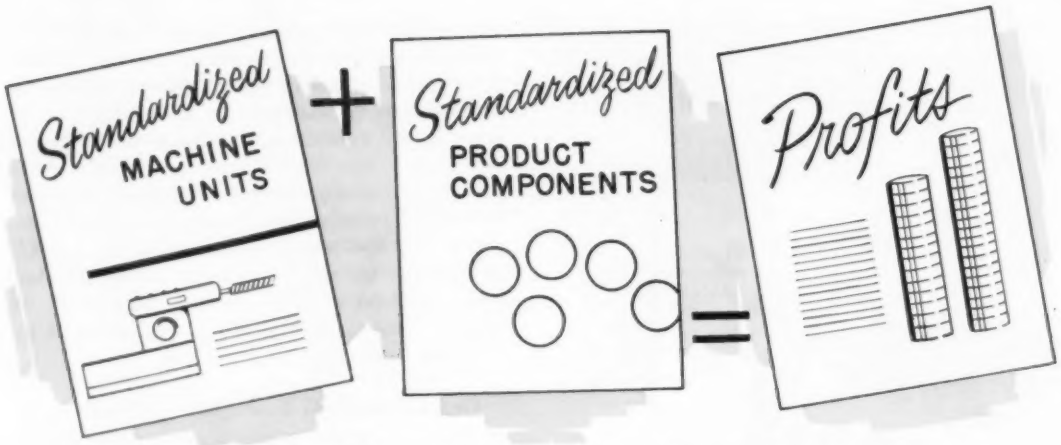
During planning, normal anticipated increases in volume, future design changes and possible improvements that may be made in loading, unloading, transferring and gaging equipment are all taken into consideration. The result is what might be termed "long-range flexibility"—a necessity if investment costs are to be kept down.

Organization: At Westinghouse, the full burden of responsibility for initiating a new plant project, or the rearrangement of an existing facility, rests primarily with the sales department. Its detailed forecast of the proposed product by style and model will have a direct bearing on the size of the physical facilities required and on the amount of the financial outlay.

All manufacturing planning is performed by a single department. The function of this department is to arrange all facilities in new and existing plants so that they operate as an integrated unit. To carry out this responsibility, manufacturing planning personnel apply cost control and cost analysis techniques to every item that enters into the manufacture of a product.

All of the equipment, operations, processing methods, tooling, layout and materials handling required to produce a product are included in the manufacturing planning function. If the planning job is done efficiently, and if engineers, buyers and production control personnel do their work effectively, line supervisors can devote themselves exclusively to the management of men, machinery and floor

Product features may be subject to some compromise to keep manufacturing cost within an established percentage of sales price.



Standardized transfer machine units and standardized product components cut investment costs, raise productivity.

space. All necessary manpower, materials, machines and floor space are available.

At Westinghouse, a component parts analysis is made for each product. Most operations in any plant consist of processing parts for the finished product. From 70 to 90 percent of all operations are in this category. Each component part may require special processing techniques that cannot be used in the manufacture of any other part. It is important to know, therefore, how many manufactured parts constitute each finished assembly and how many types and sizes of finished assemblies are included in the complete line of products to be marketed.

The parts analysis shows, in detail, how many manufactured parts are in each secondary assembly, subassembly and assembled product. Certified forecast figures of the sales department are used to determine the quantities of each component part that will be required for a month's or year's production.

Knowing how many different parts will be required, and in what quantities, the next step is to analyze each part. The study includes the part material, part shape and bulk, and machining, forming or other processing specifications.

The nature of each operation, the time required, the methods to be employed, and the equipment required to perform these operations, are determined and listed. Thus it is possible to fit the part into the over-all manufacturing pattern—a pattern that often includes automation.

Benefits of Automation: Experience at Westinghouse has demonstrated that automation offers significant advantages. Automatic loading, transferring and unloading of work make it possible to operate a machine closer to its rated capacity and with less operator effort.

Elimination of unnecessary handling, processing and inspection results in more uniform parts and less scrap. Incorporating inspection operations into production machines has been particularly effective in improving quality.

Mechanized handling, faster production, improved quality and elimination of unnecessary physical labor all contribute to reduced manufacturing costs. While the human factors involved in improved safety conditions are all-important, better working conditions lead to economic benefits as well, through reduction of lost working time.

It has been found that with automation, there is a 20 to 50 percent increase in output per square foot of floor space. Also, manufacturing cycle efficiencies are high. Parts do not pile up between operations. Banks can be scientifically calculated to meet minimum requirements and they do not exist where they are not needed.

The effectiveness of automation programs at Westinghouse has been made possible by thorough preplanning. Although major dollar savings can be made through automation, even greater potential savings exist in other areas. Approximately two-thirds of the selling price of a product is tied up in manufacturing costs. Of this two-thirds, about 50 percent is in the cost of materials, from 5 to 20 percent is in direct labor, and the balance consists of indirect labor and expense. The latter two items represent the most lucrative field for further savings.

The accomplishment of the objective—engineering a predetermined profit into a salable product—requires determination, planned strategy and well-conceived tactics. It doesn't just happen. It has to be conceived by men who have adopted the forward look as a way of life, and executed by sales, engineering and manufacturing personnel who have the faith, the confidence and the drive required to do the job.

Gadgets

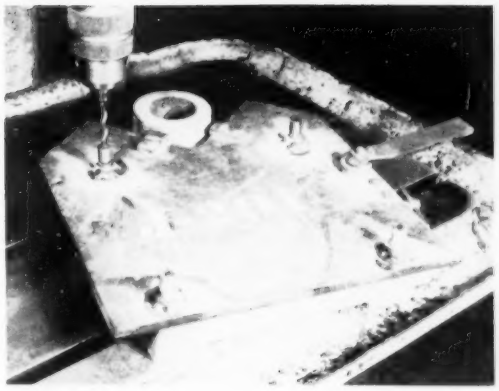
Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Welded Drill Bushings

Welding drill bushings in place is a method that might be condemned by a conscientious toolmaker. Nevertheless, when location tolerances are large and workpiece quantities are not sufficiently large to justify expensive tooling, welded drill bushings may be practical.

The template type jig illustrated is used for drilling four holes in a cast-iron workpiece. To eliminate the time-consuming process of locating and boring the bushing holes to press-fit size, the four bushings were welded directly to the top surface of the plate.

To provide maximum seating surface, the bushings are set on the plate upside down. Toolmaker's clamps are used to hold them in place for welding. Some care is required to keep the bushings vertical while welding. It is best to make small tack welds



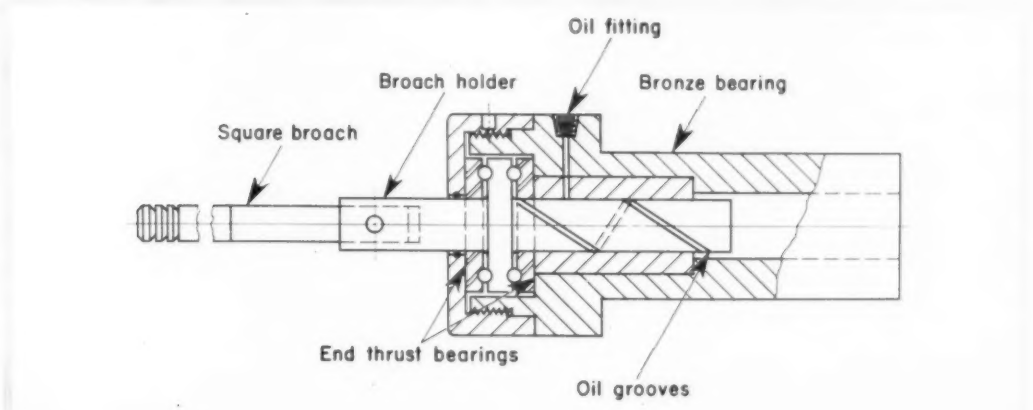
in four positions to minimize the "pulling" tendency of the weld bead. This jig and several others like it have given highly satisfactory service.

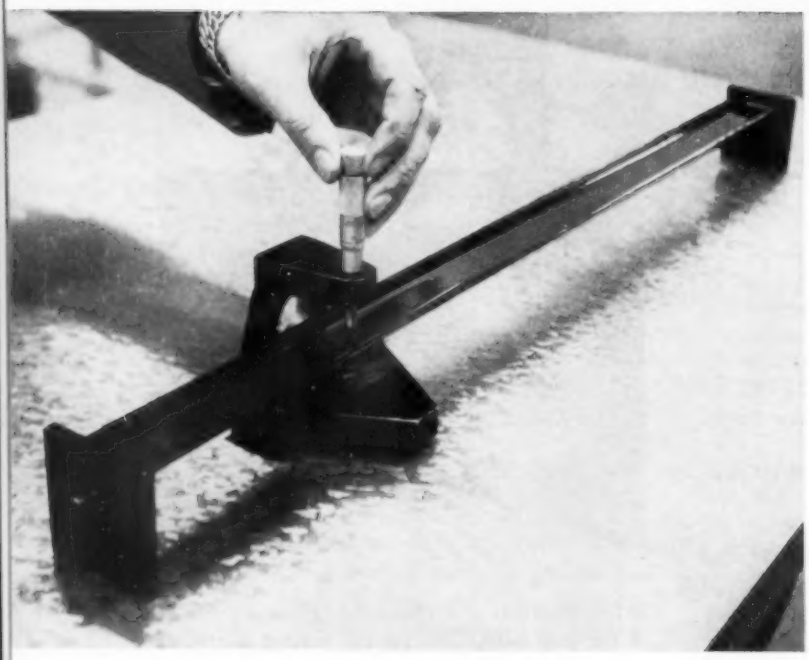
H. J. Gerber
Member-at-large
Stillwater, Okla.

Revolving Broach Holder

Square holes can be broached on a turret lathe with the broach holder illustrated. The holder is mounted in a housing held in the hexagon turret unit. A square broach fits into the end of the broach holder. In operation, broach and broach holder revolve freely with the work. As the broach is fed into a predrilled hole, it cuts the required square shape. The length of the side of the square is the same as that of the diameter of the drilled hole.

Archie Corkigian
Hamilton chapter





Oil Level Gage

Since oil "seeks its own level," the surface of a trough of oil can be used as a base plane for measurement of flatness of fixture or machine tool guideway surfaces and also for determining the flatness of surface plates. The gage illustrated, which is supported on three points, holds a micrometer spindle that gives readings to 0.0001 inch.

To use the gage, an angle-iron trough is placed on the surface to be checked and filled with oil. The micrometer spindle core point is lowered until it barely touches the surface of the oil. By moving the gage along the trough and taking repeated readings, the comparative flatness of the surface can be quick-quickly checked.

Norman F. Snyder
Saginaw Valley Chapter

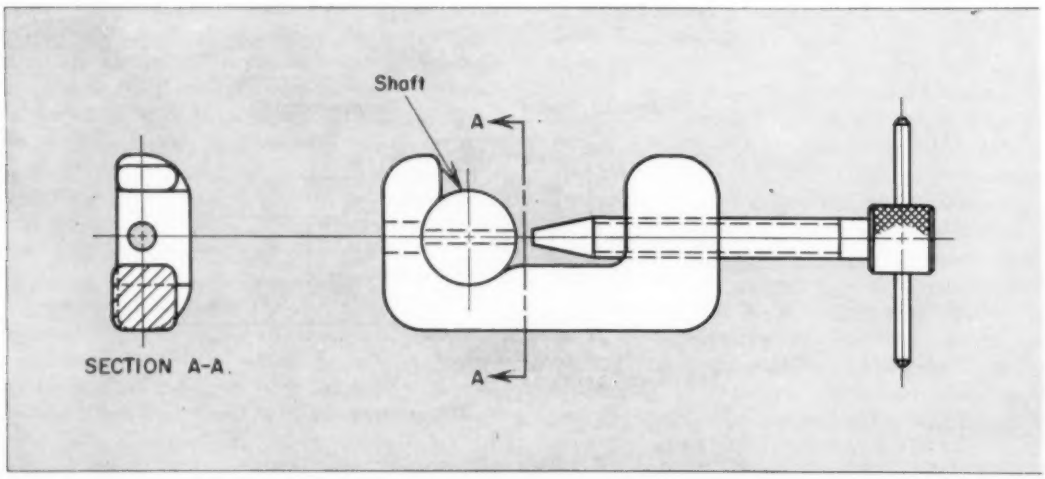
Pin Insertion Tool

Insertion of taper pins in shafts is always something of a problem. The usual method of insertion with hammer and punch, sometimes results in bending the shaft or burring the pin.

With the pin insertion tool illustrated, the possibility of damage to shafts or pins is minimized. The tool is somewhat similar to a C-clamp. One end of the tool is shaped to fit around a shaft, and a threaded punch, equipped with a handle, is mounted in the other end. The punch head is cupped to fit the end of a standard taper pin.

After a pin is positioned for insertion, turning the punch handle forces the pin into the hole. These tools can be made in a range of sizes to accommodate shaft sizes encountered in the shop.

Henry J. Colby
Hartford Chapter



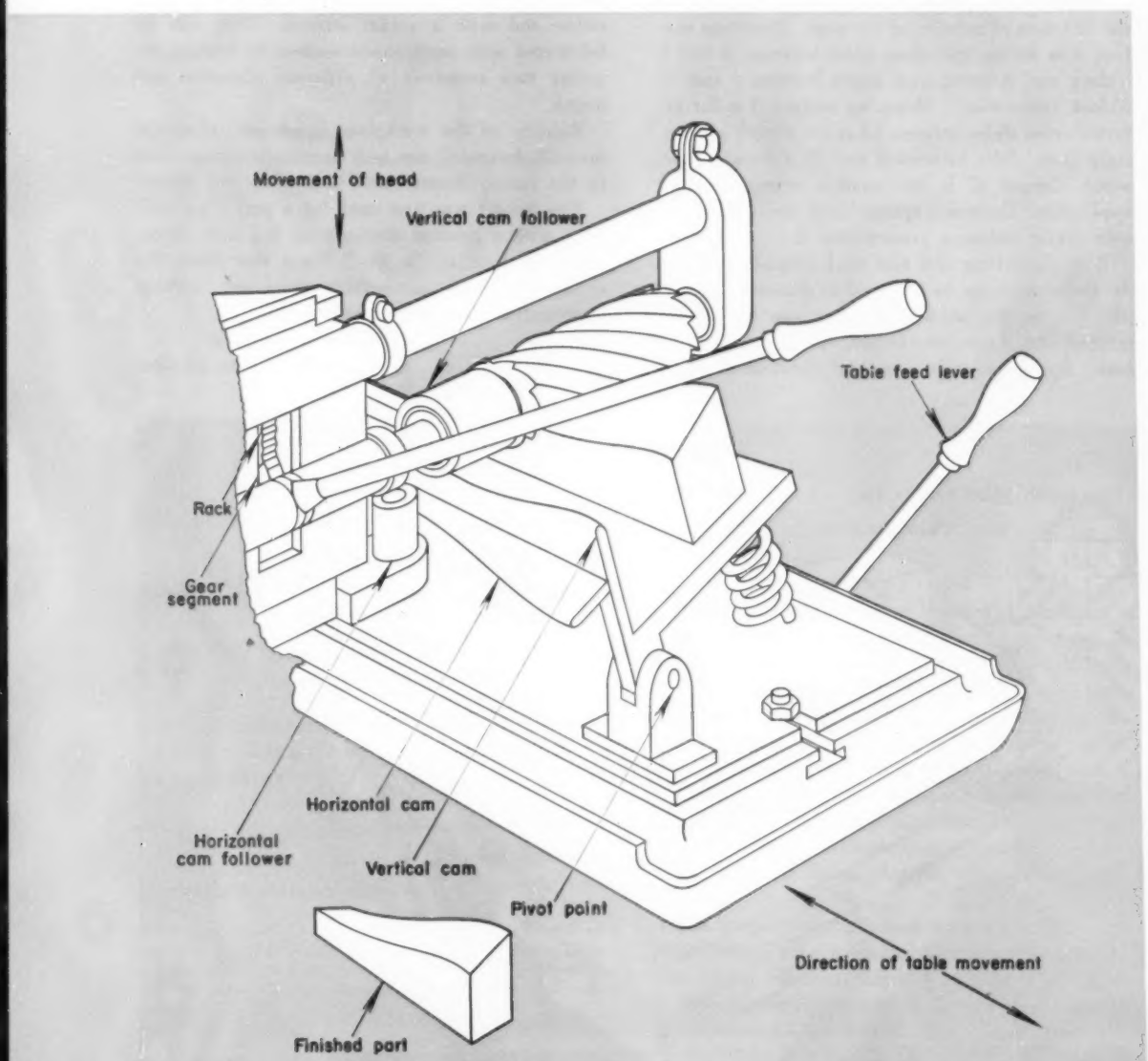
Gadgets

Machining Compound Contours

Propeller blade twists and other compound contours can be machined on a hand mill with the aid of the pivoting fixture illustrated. This fixture has vertical and horizontal cams to control the relative position of workpiece and milling cutter. During machining, the operator maintains contact between the vertical cam follower and the vertical cam with his left hand while his right hand advances the machine table. Movement of the machine table results in tilting of the fixture, controlled by the horizontal cam, and up-and-down movement of the cutter, controlled by the vertical cam. The net effect of these motions is to produce the desired contour on the part. Pressure of springs along the outer edge of the fixture forces the work into the cutter.

The vertical cam follower consists of a cold-rolled steel collar, pressed onto ball bearings which fit the machine arbor. Since the outside diameter of the collar controls the depth of cut, when the cutter is sharpened the collar must be ground a like amount. Adjustment of the machine table cross feed provides adequate adjustment for the horizontal cam.

Carl F. Stark
San Diego Chapter



Gadgets

Balanced Shaving Toolholder

Small, delicate parts are normally produced on single-spindle automatic screw machines. The balanced shaving toolholder illustrated makes it possible to produce such parts on multispindle bar machines at much faster rates.

The holder consists of two major parts: a body, which is the mounting medium, and a rocker arm, which holds the cutting tool and work support. There are two mounting surfaces on the body, making it possible to use the unit in any position served by a cross slide: either standing on an upright slide as shown in the sketch, or hanging from an inverted slide. The two mounting surfaces make it possible to maintain the proper relationship of the tool to the direction of rotation of the work. Mounting surface *A* is for upright cross slides between 12 and 6 o'clock and inverted cross slides between 6 and 12 o'clock (clockwise). Mounting surface *B* is for inverted cross slides between 12 and 6 o'clock and upright cross slides between 6 and 12 o'clock (clockwise). Length *X* is the smallest center distance applicable. There is a spacer block for cross slides with center distances greater than *X*.

With the cutting tool and work support in place, the rocker arm can be balanced to eliminate all side pressure on the work. Balancing can be accomplished with the counterweight, spring pressure, or both. Spring pressure dampens vibration in addition to balancing the tool.

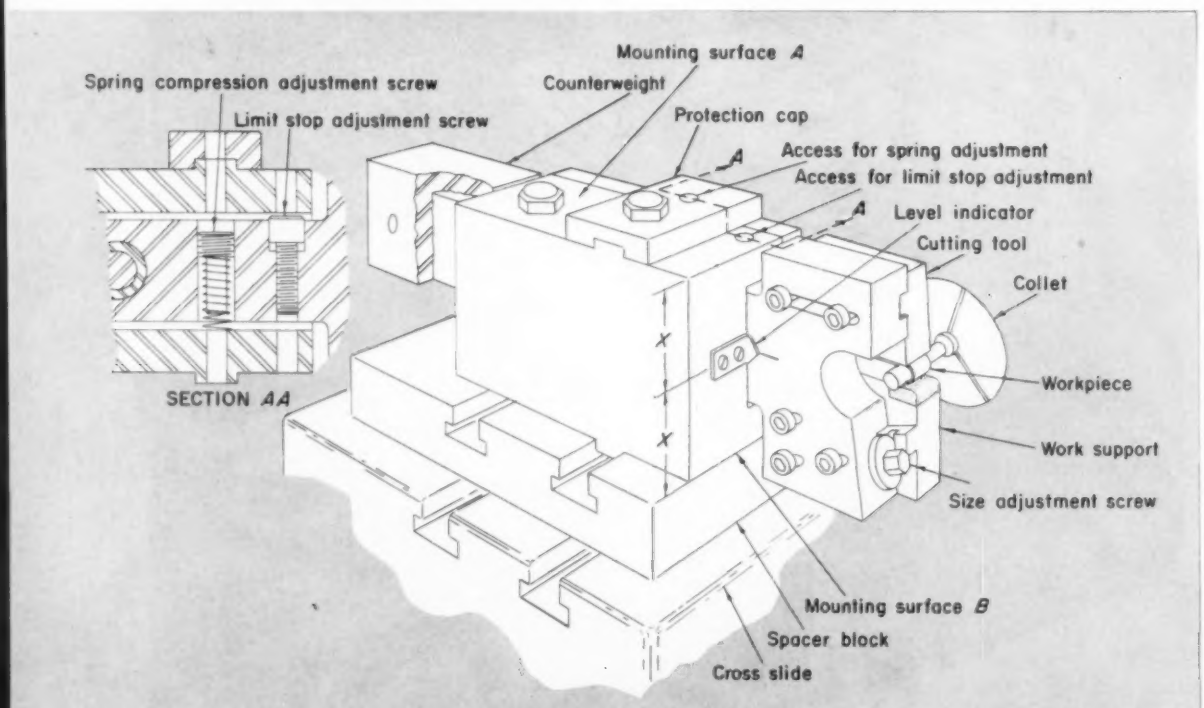
The clearance surface and the key on the cutting tool are parallel and an angular placement of the mating keyslot maintains a constant three-degree clearance angle for the tool. The tool is sharpened on the rake angle only. Resetting with a depth micrometer will maintain original cutting size throughout the life of the tool. Shifting the front holding screw to a second hole in the tool will permit the tool to be sharpened and advanced for nearly half of its original length.

The work support is keyed at a ten-degree angle to permit fine adjustment of size control. Two adjusting screws, Section *AA*, are accessible from either end with a socket wrench. They can be fabricated with ready-made sockets by brazing together two setscrews of different diameter and length.

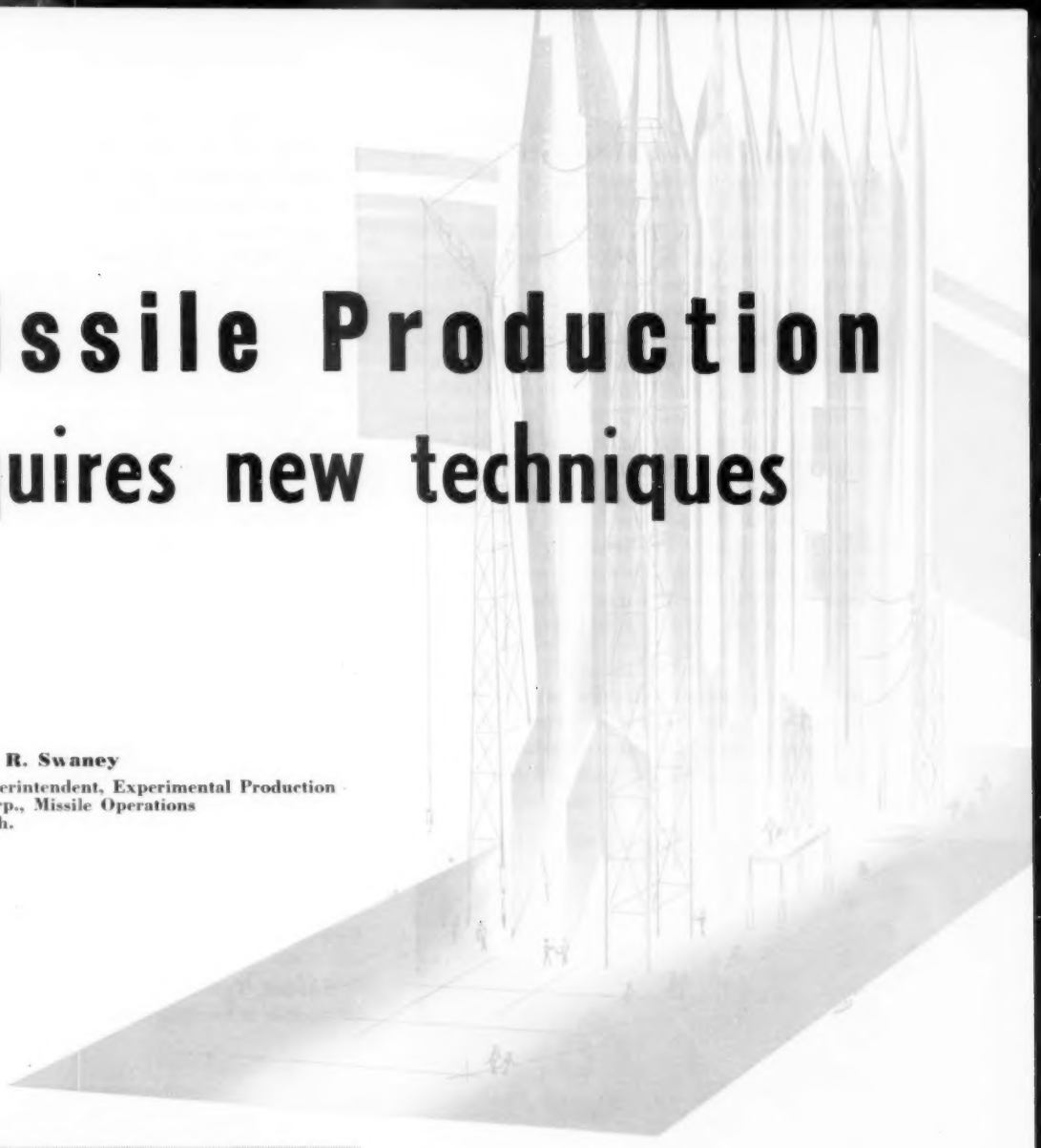
Rigidity of the workpiece is assured, since the over-all design of the unit permits working close to the collet. Maintenance and setup are simple.

This holder was first used for a part $^{15}/_{16}$ inch long, with a greatest diameter of $^{5}/_{16}$ inch. Accuracy was held to "tenths." Since that time, the holder has been successfully amplified, without modification, for many similar parts.

Allen M. Johnson
Springfield, Mass. chapter



Missile Production requires new techniques



By Frank R. Swaney
General Superintendent, Experimental Production
Chrysler Corp., Missile Operations
Detroit, Mich.

When Chrysler Corp. engineers studied missile production, they found many points of similarity between missile and auto manufacture. Special requirements for reliability, however, plus the complexity of missile design and the use of unfamiliar materials, created new problems. These were solved by creative tool engineering.

Abstracted from Paper 94, "A Production Engineer Looks at Missile Design," to be presented at the 26th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

THERE ARE MANY TYPES of missiles in the nation's arsenal, each designed for a specific mission. A missile system includes not only the missile itself, but all the necessary transportation and launching equipment. The average system has something like 300,000 parts—pumps, gyroscopes, valves, regulators, controls, computers, batteries, tubes, and a multitude of electric and electronic devices containing some 30 miles of electric wiring. The complexity of missile systems presents major construction problems. Frequent design changes add to these problems.

The urgency of the missile program requires utmost speed in the conversion of engineering information into production. Lack of specific information in time to meet delivery schedules can be considered

the most serious problem in missile production. Close cooperation is necessary between design and production to create a two-way flow of advance information.

When Chrysler Corp. first took on production of the Redstone missile in 1952, Chrysler engineers naturally compared the missile to an automobile. Both missiles and automobiles have welded, riveted and bolted structures; engines; fuel tanks; batteries; electrical systems and pneumatic and hydraulic pressure systems. These are familiar devices but when the engine power or thrust, fuel consumption, number of electrical connections and speeds of a missile are compared to those of an automobile, the differences become staggering. New materials and methods still under development must be considered. The quality and reliability requirements are at least one order greater than those for aircraft. Because of the nature of a missile, there are necessarily many unusual manufacturing operations, *Fig.* 1.

Electrical Components: The relay box shown in *Fig.* 2 is an example of the complex nature of missile manufacture. This box contains over 6000 wires, requiring over 12,000 soldered connections. Dozens of these boxes are used in each system. Originally, the boxes were built up complete by individual employees, each of whom had to have ability in wire layout, lacing, preforming and soldering. By creating preformed harnesses, diagrams and peg boards, it was possible to spread these operations among several wire assemblers of lesser technical ability.

With the extremely large number of soldered wire connections required in missile production, improvements in soldering techniques were required. Previously two resistance type soldering methods were used: the high-heat, short-time-cycle method and the low-heat, long-time-cycle method. While the high-heat method was fast, it resulted in many cases of melted, distorted wire insulation and arcing between contact points of terminals and electrodes. The low-heat method was slow and caused an objectionable oxide coating to form on the surface of the solder. These objections were investigated and a better and faster method was developed by combining some of the best features of each.

This was accomplished by increasing the applied temperature considerably above the necessary soldering temperature for a short period of time (½ to 2 seconds) and then decreasing the temperature to just above the liquefaction point of the solder. It was found that a quick, hot temperature for a few seconds followed by just sufficient heat to maintain the solder in a molten state provides a decrease in soldering time without the difficulties inherent in high or low-heat soldering.

Special Testing: Another problem in missile production is handling high-pressure air. In a mis-

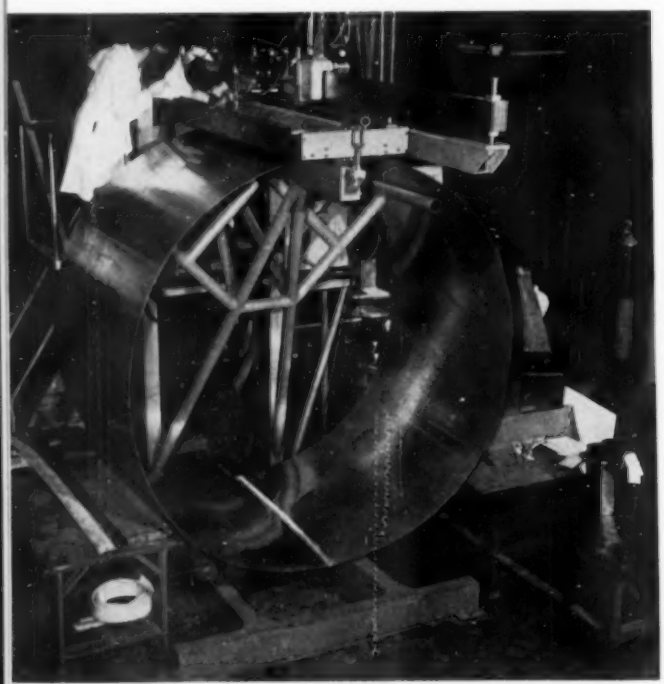


Fig. 1. Longitudinal welding fixture is capable of handling a six-foot longitudinal weld.

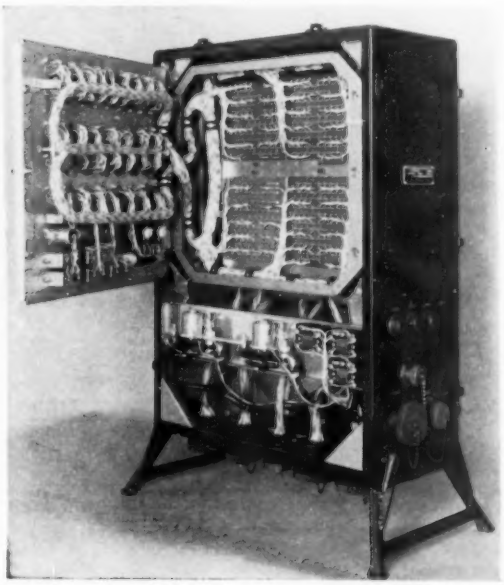


Fig. 2. (right) Missile system relay box contains over 12,000 soldered wire connections. New soldering techniques speeded construction without burning wire insulation.

sile, many of the control devices are operated pneumatically at high pressure. Also, air must be forced into the tanks to replace the fuel as it is consumed in flight. Air for fuel combustion is stored under extremely high pressure in spherical tanks located throughout the missile. To check and test components under this high pressure—and also the complete missile under somewhat lower pressure—requires extreme precautions for the safety of test personnel. A pressure test house was developed, *Fig.* 3, which can house a complete missile or smaller components. The test house is constructed of extremely heavy woven-wire mesh welded to a steel framework. The wire mesh has sufficient open area to let an air blast through and enough combined mass strength and elasticity to absorb a high-velocity impact. A steel ball fired into the mesh with a velocity of 1800 feet per second failed to penetrate the mesh. Previous to the development of this pressure test house, cumbersome sand bags and concrete structures were used to protect personnel while high-pressure testing was in progress.

Cleaning: Special safety precautions are taken to be certain that any tubing or tanks that will contain liquid oxygen or hydrogen peroxide fuel are chemically clean. Violent explosions may result if these fuels come in contact with any foreign organic matter. A tube cleaning stand, *Fig.* 4, was developed. This stand incorporates tanks for cleaning solutions. Tubes are connected through stainless-steel flexible hoses and are cleaned with trisodium phosphate, rinsed with water, acid etched, rinsed again and finally dried with warm, filtered air. The sequence of operations is automatically controlled by a timing mechanism. The proper cycle for stainless-steel or aluminum tubing is set with a selection switch.

Optical Tooling: Alignment of the various sections and components of the missile must be held to fairly close tolerances. After considerable study optical tooling was adopted for this purpose. A typical example of how optical equipment is used is the alignment of the rocket engine. The purpose of alignment is to determine the actual thrust angle in relation to a line perpendicular to the mounting pads and on the geometric center. The rocket engine is suspended in a horizontal position from a holding fixture. Using an optical transit, the mounting pads are aligned in a perfect vertical plane. With the aid of an optical square, a tubular fixture containing a collimator is positioned on the theoretical thrust axis. This tubular fixture is also equipped with two dial indicators 24 inches apart. By rotating the fixture and taking readings every 30 deg, enough data is obtained to determine the exact exit and thrust angle. The engine is rotated 180 deg to compensate for any sag and the 30-deg readings are again recorded. The engine is then mounted to the missile center section and another optical check is performed. The fixture is then positioned on the center section center line and the actual thrust angle and exit displacement is determined in relation to the center section.

Certain machining work in the missile must also be held to very close tolerances. For example, the mounting for the stabilized platform which is the heart of the missile guidance system must be held in relation to an alignment rod within 0.000022 inch. Machining to these tolerances can be accom-

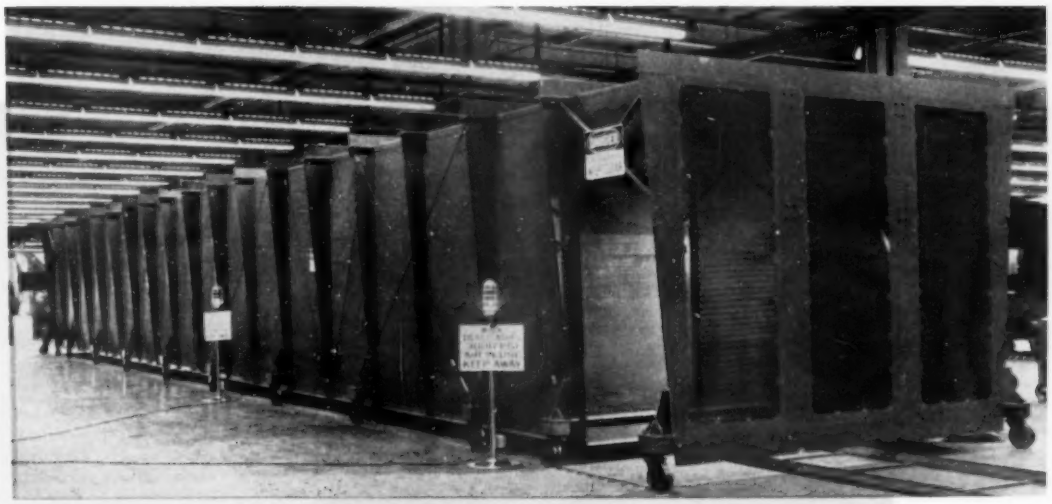


Fig. 3. Test house for checking high-pressure equipment. The walls are constructed of heavy wire mesh which allows air flow but can absorb a high-velocity impact.

plished only on accurate jig boring machines under controlled atmospheric conditions.

Welding: Many new welding problems were encountered in construction of the Jupiter missile because the aluminum alloys specified for the ballistic shell were themselves new. A welding development group was established to study these problems. This group is primarily concerned with development of welding processes and techniques and their adaptation to production use.

Welding development was divided into two phases. During the first phase, welding techniques and methods for welding the Jupiter ballistic shell were developed. A fixture was designed and built and controlled welding begun. This fixture is capable of handling a six-foot longitudinal weld and is of sufficient height to permit welding cylindrical pieces.

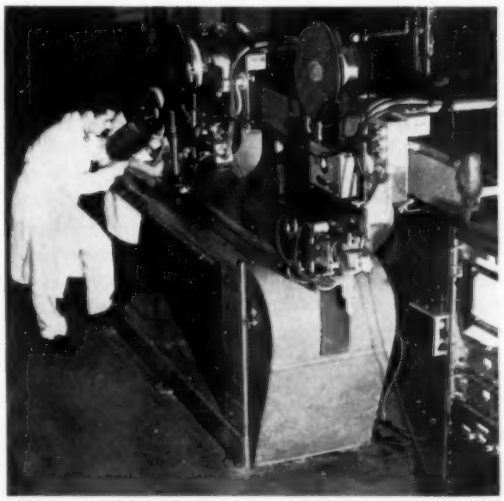
The fixture provided considerable data and useful knowledge for future operations. For example, the importance of good hold-down design and controllable spacing and pressure was determined. Proper backup materials and groove shapes were determined to obtain proper penetration and heat dissipation.

The second phase involved controlled welding tests on high-strength aluminum alloys, utilizing a new commercial fixture, *Fig.* 5, designed to incorporate all features that previous work dictated. This fixture has a 72-inch horizontal welding length. Short, closely-butted copper fingers extend the length of the weld area. The hold-down fingers clamp the work by means of adjustable and regulated air pressure. Spacing between opposed fingers is adjustable, permitting variations in quenching conditions.

The fixtures mount automatic welding heads for both the consumable and nonconsumable electrode processes. Various power sources were used to determine the combination most suitable from both the weld quality and production standpoints.

It has been demonstrated that, with properly controlled welding conditions, consumable and nonconsumable electrode welding of 5086-H34 (high magnesium content) aluminum give comparable quality and strength results. Joint efficiencies are over 90 percent. Sufficient yield strength and ductility are obtained along with weld soundness, as determined by radiographic and metallurgical tests. An electronic recorder to chart values of travel, wire feed speed, welding voltage, welding current, and line voltage establishes exact values that are transferable to other production welding equipment.

Missile production is a constant task of development. It reaches into entirely new areas of methods and materials. The resolution of manufacturing techniques unique to missiles is a stepping stone to even more efficient production in the future.



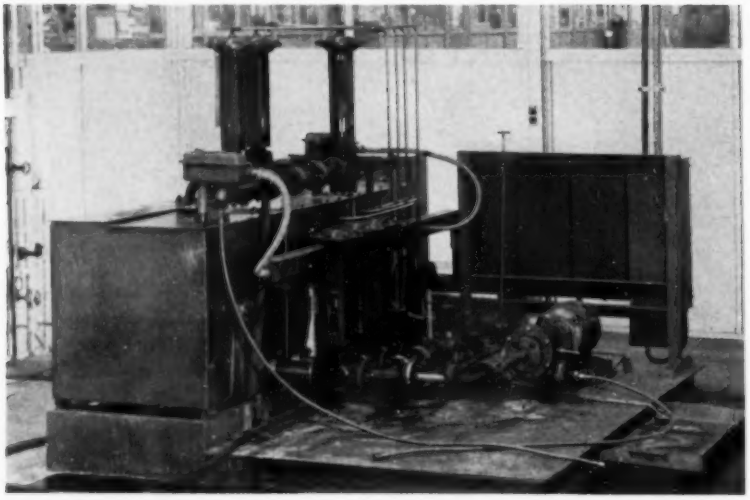


Fig. 4. (left) Stand for cleaning tubing and tanks which will contain liquid oxygen. A selector switch provides the correct automatic cleaning cycle for either stainless-steel or aluminum tubing.

Fig. 5. (above) Horizontal welding fixture has a 72-inch welding length and mounts automatic welding heads for both consumable and nonconsumable electrode welding.

Fig. 1. Plastic checking fixture is inexpensive and easy to handle. It weighs much less than a comparable steel fixture and can be quickly and economically fabricated.

PLASTICS in plant tooling

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OPPORTUNITIES FOR REDUCTION of cost without sacrifice of quality are possible through intelligent application of plastics in the fabrication of tools, fixtures and gages. The extent to which these plastics can be utilized has been demonstrated by the use of commercial laminated phenolics and epoxy resins in the manufacture of aircraft engines.

Tooling Applications: At Lycoming, plastics have been used for both large and small tools and fixtures. Size may vary from a drill jig 42 inches in diameter to a plug gage 7 inches in diameter. It has been the experience at Lycoming that plastics have five basic advantages for fixture applications:

1. Economy of fabrication. A deflector checking fixture, *Fig.* 1, for example, which would have cost an estimated $800 if made of steel, actually cost $35.00.
2. Saving in weight. The deflector checking fixture il-

lustrated weighs only six pounds. This light weight minimizes employee fatigue.

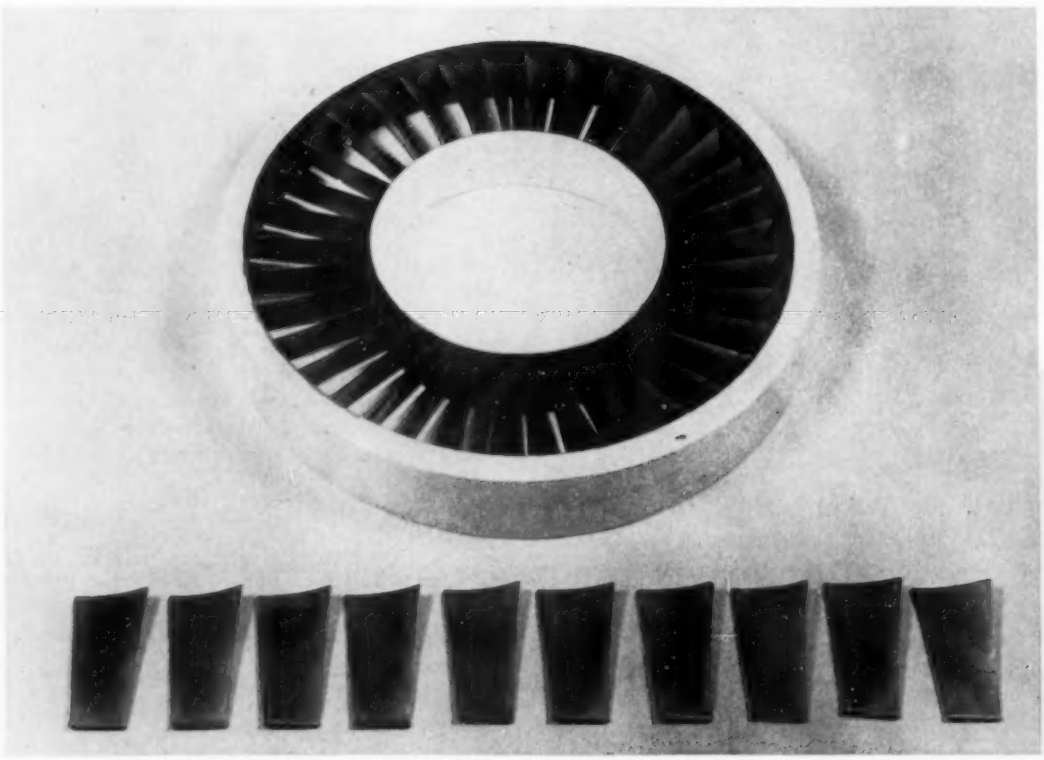
3. Ease of making changes. Plastic fixtures can be modified faster and more economically than steel or plaster fixtures in the event of an engineering change.
4. Ease of duplication. Reproductions of a plastic fixture can be made quickly and inexpensively.
5. High level of durability. Plastic fixtures are much more durable than equivalent plastic fixtures. They can even be dropped without damage.

Similar advantages are obtained with other plastics tooling. An outstanding example of the use of plastics for tooling is a holding die to swage tubing. The tube must be held within 0.001 inch of true reading. To make the die of steel would cost about $2800. The cost of plastics was only $468 or less than 20 percent of the cost of a steel die. Die-sinking and machine tooling, as well as tool design costs, are eliminated. In addition, the plastic die can be cast to a form.

Another interesting tooling application is illustrated in *Fig.* 2, showing rubber dampener plugs. They are used to eliminate static vibration when

Fig. 2. (left) Rubber plugs reduce static vibrations of workpiece on turret lathe.

Fig. 3. (below) Turbine engine inlet shroud assembly for test purposes. Plastic fabrication saved a month in time as well as a large cost savings. Blades are three inches long, one and three-quarters wide.



machining a diffuser housing for turbine engines on a vertical turret lathe. Soft solder plugs had been used previously. To remove the solder, the housing was dipped in hot water. This caused the housing to rust. With a plastic plug, there is no rusting problem. Plastic plugs can be re-used indefinitely. The heavier plug is 14 inches in diameter, 2½ inches thick; the lighter one is 17 inches in diameter, 1¼ inches thick.

Economy of fabrication is particularly advantageous in the construction of contour and length checking fixtures made of steel and epoxy resin. To fabricate the plastic restraining blocks of steel would cost an additional $200. The inlet shroud for test purposes illustrated in *Fig.* 3 is another useful application where plastics saved valuable time.

The potential savings in weight are illustrated by the masking fixture in *Fig.* 4. The same advantages are seen in gage applications. As an example, a plug gage cost was $58 when made of plastics, as compared to approximately $275 for a metal gage. The plastic gage is easy to handle because of its lightness. With the addition of more resin and a little machining, it can be converted for measurement of larger holes.

Fabrication: Lycoming fabricates plastic fixtures in the following steps: A steel surface plate, 4 by 6 ft, is cleaned thoroughly and waxed. Then a layer of resin is applied, followed by a length of glass cloth, followed by a layer of resin. This process is continued until the desired thickness is reached. It takes approximately 52 layers of glass cloth to reach a thickness of one inch. After curing, the laminated strip is removed from the surface plate and machined to size. Masters are used when possible. It is only from masters that optimum accuracy can be achieved.

Construction of the masking fixture shown in *Fig.* 4 illustrates the steps in casting plastic pieces. A counterweight is waxed and placed in an aluminum box. The box is waxed. A mixture of resilient epoxy resin is poured in and left to dry at room temperature. Wax allows for easy removal of the masking fixture following drying.

Repair and Maintenance: An example of the utility of plastics for repair is illustrated in *Fig.* 5. This repair work was done on a toolroom milling machine when a table feedscrew bracket broke. If brazing were used it would have resulted in distortion of the metal, a machining job and many hours of lost time. Lycoming replaced the steel bracket with an epoxy resin bracket and the machine was back in operation within half a day. With brazing, the repair would have required two or three days. The plastic repair has been found to

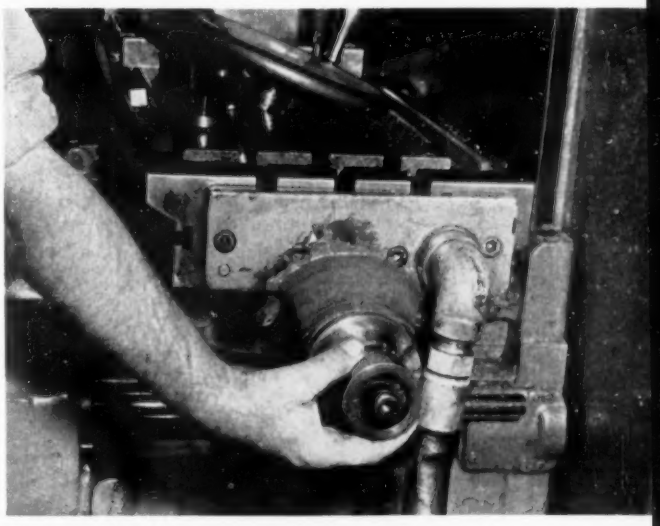


Fig. 5. When the feedscrew bracket broke on this toolroom milling machine, it was replaced with epoxy-resin laminated plastics. Time for repair was one-half day, whereas conventional methods would require two to three days.

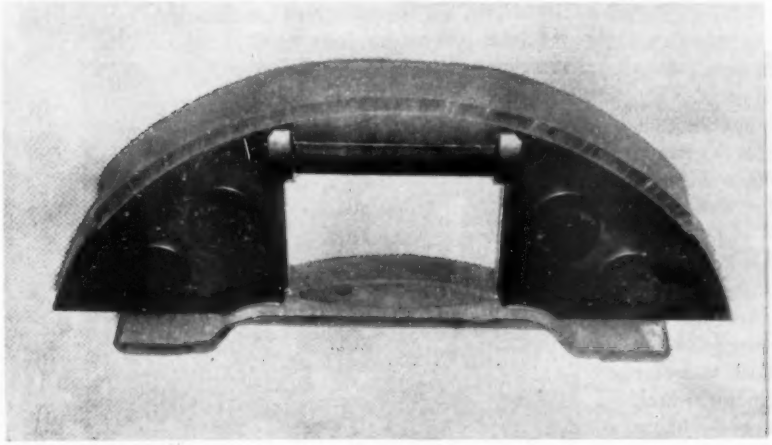


Fig. 4. Masking fixture for grit blasting of aircraft engine counterweight. It is 13 inches long, 5 inches wide and 1½ inches thick. Previous cast-iron fixture weighed 13 pounds; plastics weigh 1.75 pounds.

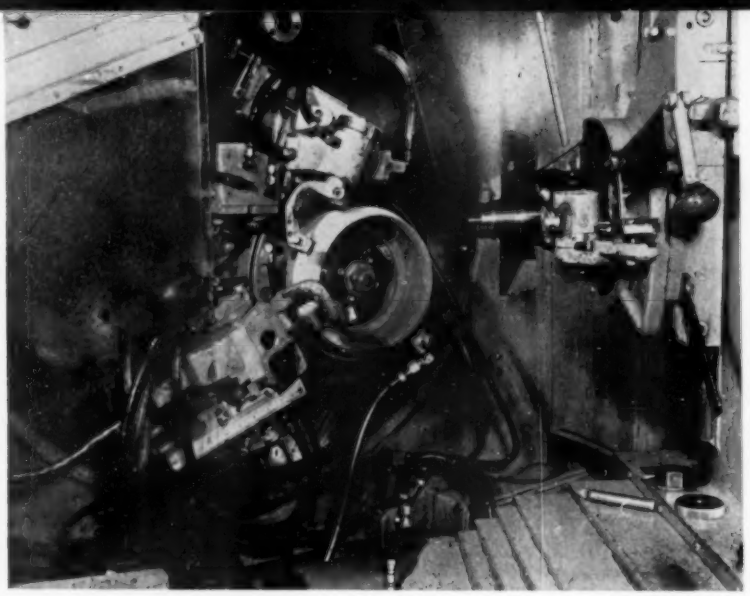


Fig. 6. Guard on gear grinder was replaced with plastics in four days. A steel welded guard would require three weeks for replacement. The guard weighs two-thirds that of steel. Cost is $40 compared with $60 for steel guard.

be at least as strong as welded or brazed cast iron.

The grinding wheel guard shown in *Fig.* 6 was quickly fabricated from plastics to replace a broken metal guard. An example of effective use of plastics for maintenance is the lining of a copperplating tank. The steel tank had been made inoperable by electrical eddy currents which caused false readings on ammeters. A plastic liner was put on the interior of the tank as an insulation and has proved itself effective. Another example is the use of plastics to line a cold water rinsing tank. By using an epoxy resin, Lycoming was able to stop rusting of the steel and avoid purchase of a special tank for the water. This illustrates the versatility of plastics.

There are, of course, limitations on the use of plastics in industry. Specifically, products which require extreme close tolerances do not lend themselves to plastics at present. When plastics for tooling was new, tool designers did not consider the new material. It was only when a metal or plaster fixture failed or an emergency developed that the plastics engineer was called in, almost as a last resort.

This condition is now changing. Tool designers work with plastic applications in mind. The result is better for the plastics engineer, better for the tool designer and better for the plant as a whole.

Plunge Grinding Succeeds on Tricky Work

PROBLEMS in turning unusually small armatures were solved by the application of a Dumore attachment for plunge grinding. Initially the armatures could not be turned on a standard lathe because of two nylon flanges on each side of the short length commutators. The armature shaft is 1¼ inches long; width and diameter of the commutator is ¼ inch. Because of these small dimensions, the cutting tool could not be brought up against the commutator without striking the shoulder of the flange. Rivet Lathe and Grinder Inc. solved the problem by plunge grinding with a wheel the width of the commutator.

Because the armature to be ground is held on its own bearings in V-blocks, concentricity between bearings and commutator is assured. Arm and motor assembly is canted slightly so that the drive belt thrusts the armature against the V-block to locate work properly in relation to the grinding wheel. Proper grinding between flanges is assured without risk of striking flange shoulders. The grinding spindle, mounted on a slide rest base, is equipped with screw and dial for feeding into the work. A stop bracket on the base assures repeating size.

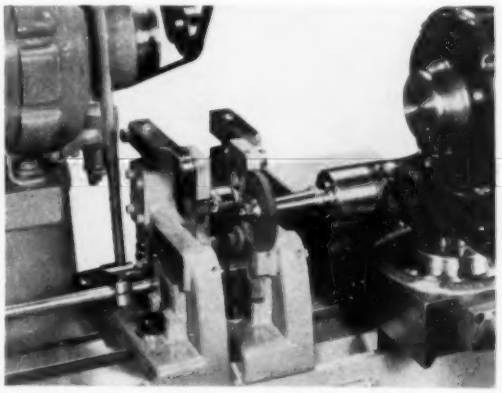


Fig. 1. Placing a machine in a pit improves operator safety and efficiency, thus lowering metal-cutting costs.

reducing METAL-CUTTING COSTS

By Robert T. Hook
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Machines and machining methods, cutting tool materials, and workpiece materials are studied by Warner & Swasey engineers to find ways to reduce manufacturing costs. Their experience makes a useful practical guide to other tool engineers.

Abstracted from Paper 72, "Cutting Metal-Cutting Costs" to be presented at the 26th Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

COST CUTTING and improved metal cutting go hand in hand. With the vast amount of money currently being spent to remove metal in the form of chips, even a small across-the-board increase in efficiency can be important, not only in individual shops but to the nation as a whole.

Scheduling: Selecting the best machine or machining process for a given metal-cutting job is, of course, all-important. There are, however, many other factors of equal importance from a cost-reduction standpoint. Even the most efficient metal-cutting operation can be costly, for instance, if lot sizes are not economic.

A 25-piece lot may be a maximum economical production run on a hand screw machine in comparison to a single-spindle chucking automatic, due to the relatively long setup time. It is the tool engineer's job to be acquainted with the economic lot sizes for all the machines in his area. Thus, he can make sure that parts are scheduled according to lot size so that setup costs per piece are minimized.

Setup costs can be minimized by grouping similar parts and scheduling them to be run as a group.

Fig. 2. Automatic chuckers can be placed face-to-face so that one operator can conveniently handle two two machines.

Such scheduling has made it possible to use high-production multiple-spindle automatics for job-shop work. Change-over from one part to another involves changing only a few tools and making minor adjustments. This cuts setup costs substantially compared to the cost of making a completely new setup for each part.

Separate cutoff or "slugging" operations also offer advantages when considering the break-even point for screw machines. Slugging takes costly cutoff operations away from a bar machine in a high-overhead department and places these operations in a lower-overhead department, such as a stock section, where fast, special-purpose automatic cutoff equipment can be utilized.

Another step that can be taken is the drilling of holes on a standard drill press in the free time of the operator handling the automatic cutoff machine. This permits faster speeds on both hand screw machines and automatic chuckers, since speed will not be limited by the need for high-speed steel drills and carbide tooling may be used exclusively in all machine positions.

Ergonomics: Another factor that is now influencing the design and use of machine tools is "ergonomics," commonly called "human engineering." This is a science that deals with the problems of seeing and doing. It involves the study of men and work and how they react in all kinds of machine-man situations. Mental, as well as physical, needs of the worker are considered.

Operations have been studied from a human engineering point of view for many years. The practice of placing machines in pits to eliminate the requirement for "cliff dwellers," *Fig.* 1, is an example of an improvement based on ergonomic principles. Grouping machines in centers where one man can operate two or more machines satisfactorily, *Fig.* 2, is another good example.

Ergonomics has also been applied to the design of machine tools. By fastening lights to a machine operator's hands and taking a time-exposure photograph as he operates a machine, it is possible to obtain a record of all motions involved, *Fig.* 3. Such photographs often suggest ways to relocate machine controls to permit greater operating efficiency and reduced fatigue.

Tool Materials: The advent of the vacuum-sintered or premium-grade carbides has added tremendously to the cost saving potential of metal removal operations. These materials make possible higher speeds with the same rate of feed and depth of cut used for the older carbides, operating at slower speeds. When properly installed and properly used, the new carbides can bring many benefits.

On the other hand, haphazard introduction of these new tools into a shop can easily defeat cost-reduction programs. Some difficulties can be avoided by analyzing new cutting tools on a large sample of production parts. The fact that test work

Table 1—Machine Handling Time vs. Cutting Time

Handling Time (sec)	Approximate Cutting Time (sec)				Handling Time (percent)
	High-Speed Steel	Carbide	Premium Carbide	Ceramic	
30	240	-	-	-	11.1
30	-	45	-	-	40.0
30	-	-	30	-	50.0
30	-	-	-	15	66.6

is done in the laboratory, however, does not mean that when a new carbide is placed in the shop there are no problems. Often, laboratory findings have to be modified before any across-the-board use of the new materials is possible.

Today, due to preliminary laboratory work and test runs in the shop, vacuum-sintered carbides are used exclusively in the Warner & Swasey turret lathe department. It has been found that cutting speeds can be increased substantially over existing standards when the new materials are used. When the hardness of the workpiece material is 163-223 Bhn, speeds can be increased 40 percent over the speeds used with conventional carbides, with no loss of tool life. Materials with a hardness range of 223-321 can be machined at 25 percent higher speeds and a 20 percent speed increase can be realized when material hardnesses are in the 321-363 Bhn range. Cutting speeds for cast iron can be increased 50 percent.

Use of vacuum-sintered carbides has reduced metal-cutting costs substantially. There are 49 turret lathes in the Warner & Swasey Cleveland plant, operating 16 hours a day. A 5 percent average reduction in floor-to-floor time resulting from faster cutting speeds has resulted in a $68,600 yearly saving, based on hourly costs and short run production.

The cermets or titanium carbides may contribute more quickly than ceramics to economical production. In one case, for instance, boring a hole with titanium carbide tools has replaced a grinding operation. A 35-micro-inch finish is obtained and the boring operation is much faster than the previous grinding operation. An added advantage is that six smaller holes can be bored in the same boring mill setup without relocating the workpiece.

With the advent of the newer carbides and ceramics, plus a great deal of thinking on optimum tool life, throwaway inserts, scientific metal-cutting research, increased power and speeds, and greater rigidity in machine tools, machine handling times are becoming far more important than in the past, as shown in TABLE 1. As metal cutting has progressed from high-speed steel cutters through the early carbides to the improved carbides and ceramics, handling time has taken an increasingly large percentage of total floor-to-floor time.

With automatic operation, many machines are unattended for long periods of time. This may mean that there will be a trend back toward "tried and true" tools, with emphasis on reliability rather than on extremely high speeds. The trend may well result in tools with speeds lower than those obtainable with ceramics, but higher than those obtained with present-day carbides. The titanium carbides are promising materials in this respect. Cost-conscious tool engineers are keeping in close touch with all developments in the field of tool materials, keeping in mind that an increase in cutting speeds alone is not always the best avenue to reduced costs.

Workpiece Materials: The materials available today for fabricating standard production parts offer a great opportunity for reduction in floor-to-floor time with little or no sacrifice in the mechanical properties of the end product. Steel mills are offering a variety of materials that give excellent functional performance and, at the same time, are more machinable than comparable materials.

The two factors required for good machinability are low hardness and low ductility. These factors are at opposite ends of the machinability yardstick. Full annealing results in low hardness. High ductility, on the other hand, is associated with high hardness.

One solution is the use of cold-finished materials. Such materials have a combination of low ductility and low hardness that can raise machinability between 5 and 8 percent, making it possible to increase cutting speeds with no increase in tool wear.

Leaded steels also have improved machinability.

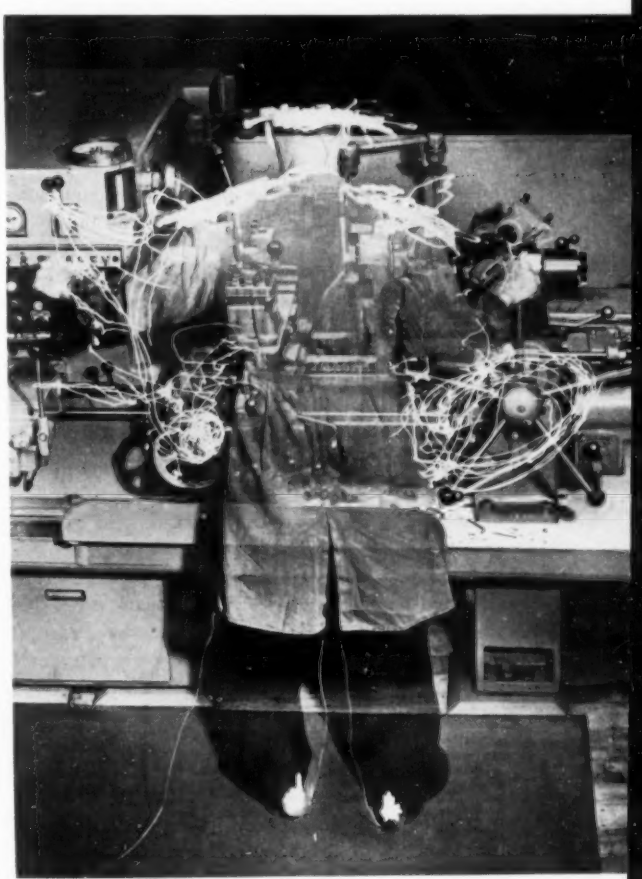


Fig. 3. Studies by light trace photography show how controls can be actuated without waste motion on a well-designed machine tool.

Table 2—Relative Machinability of Various Materials

Previous Material Specification	New Material Specification	Machinability Improvement* (percent)
C-1020 H.R.	C-1117 H.R.	35
C-1117 H.R.	C-1117 C.F.	5
C-1117 H.R.	C-1117 H.R. (leaded)	35
C-1045 H.R.	C-1141 H.R.	11
C-1141 H.R.	C-1141 C.F.	8
C-1141 C.F.	C-1141 C.F. (leaded)	27
A-8615 H.R.	A-8615 H.R. (leaded)	13
A-4140	A-4140 H.R. (leaded)	30
A-4140 (90% lamellar pearlite, 10% spherodized)	A-4140 (65% lamellar pearlite, 10% spherodized)	22
A-4140 (90% lamellar pearlite, 10% spherodized)	A-4140 (100% spherodized)	54
A-4150	A-4140 H.R. (leaded)	34

*All machinability references are to turning and are calculated from data in the ASM HANDBOOK SUPPLEMENT.

Experience has shown that leaded materials can be machined 25 percent faster than conventional materials with no increase in tool wear. An additional advantage is the better surface finish obtained at higher speeds. Similar increases in machining speeds can be obtained with resulfurized steels.

Microstructures can be modified to improve machinability and surface finishes. This was demonstrated when the causes of poor surface finishes on gears of A-4150 and A-4340 steel were analyzed. Because of their shape, many of these gears could not be ground, so the required finish had to be obtained prior to heat treating. The poor surface finishes were noted by score lines in gear shaping operations.

A study of the microstructures of both materials indicated that scoring occurred when the gears had 100 percent spherodized microstructures. Various microstructures, ranging from 100 percent spherodized to 100 percent lamellar pearlite were studied to find microstructures that would result in minimum scoring.

It was shown that with a 65 percent lamellar pearlite and 35 percent spherodized structure, scoring of A-4150 material was no longer a problem. For the A-4340 material, a 50 percent lamellar pearlite, 50 percent spherodized structure gives best results. This demonstrates that there is a specific structure which is desirable for each type of metal-cutting operation. Some of the gains in machinability resulting from improved materials that can be obtained are shown in TABLE 2.

It is possible to obtain desired microstructures by indicating the requirement on purchase orders to steel mills. In some 25,000 hours of gear cutting, only 17 repair hours have been spent in additional shaving operations to get the finish required. Thus, the mills have done a consistent job of furnishing satisfactory materials.

Other Ways to Cut Costs: There are, of course, additional ways to reduce metal-cutting costs. Tracer turning, for instance, has increased the productivity of turret lathes eight-fold in some cases. In other cases, there is no saving in actual machining time but there are substantial savings through reduced tool wear and setup costs. In addition, rejects due to operator errors are minimized.

Machine vibration studies are another promising field for cost reduction. Some tool engineers find it worthwhile to consider vibration checks of troublesome jobs before making any changes in tool geometry. Vibration can be a primary factor in early tool failure.

This vibration is not necessarily caused by out-of-balance conditions. Workpieces or tools can sometimes act like a tuning fork, developing harmonics which are accelerated rapidly under cutting forces. Additional work in this field will ultimately have an important bearing on reduced tool costs.

Whenever cost reduction programs are under way, it is well to take a broad look at all metal-cutting operations in a plant. A 5 percent improvement throughout one department or one plant will have a greater impact on costs than a 200 percent improvement on a few jobs. Also, in the final analysis, machine operators are the only ones who can convert potential savings into actual savings, so their problems must be kept in mind.

"Oh, it's easy to make when you have the proper tools. . ."

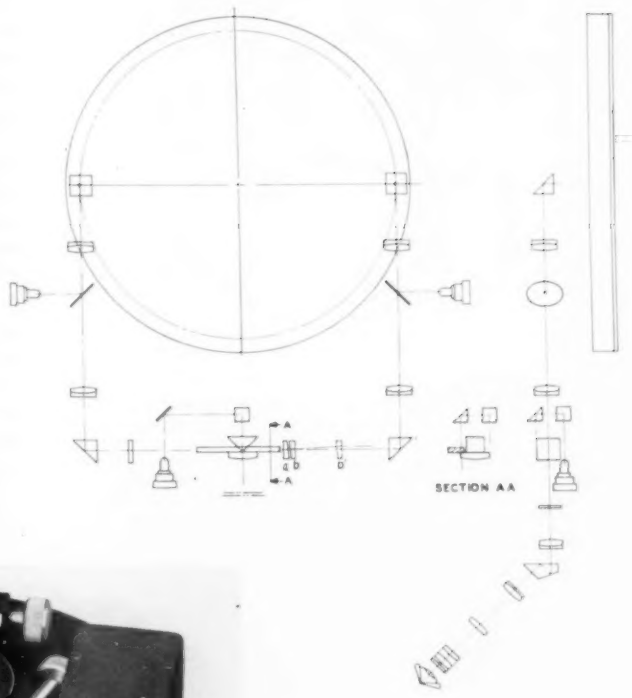
designed for

PRODUCTION

Optical System Positions Tooling Accurately

Using an optical coincidence reading system plus a precision divided circle, any tooling with a stationary shaft can be positioned within one second of arc. The system, called Unisec, has an optically flat glass circle with 2160 graduations as well as prisms, lens and a microscope. Readings from any stance can be obtained through the 360 deg swiveling microscope eyepiece which contains a deviating prism.

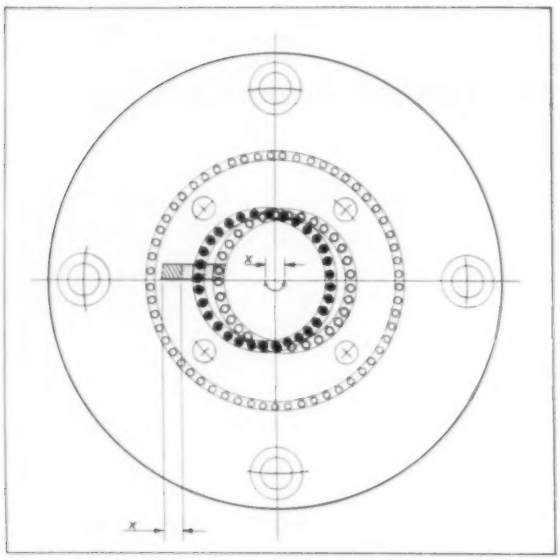
Basically, the coincidence reading principle permits reading two sides of a circle simultaneously. By so doing, eccentric errors are eliminated and true readings within 10 minutes of arc are made. Each 10 minute interval is divided into 300 equal parts on a micrometer scale for more accurate readings.



SCHEMATIC diagram of Unisec optical coincidence reading system components.

ASSEMBLED optical system completely enclosed for protection of the precision divided glass circle and optics. Swiveling microscope eyepiece is located on the front face for ease of operation.

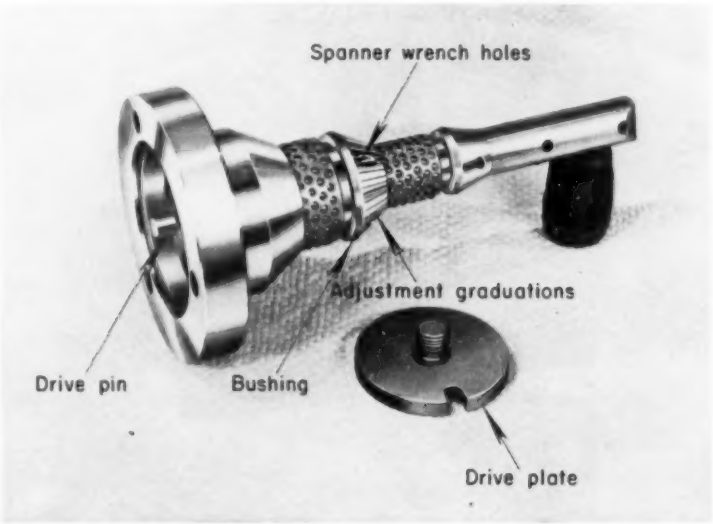
Eccentric Bushing and Preloaded Balls Assure Boring Head Accuracy



ADJUSTMENT PRINCIPLE of the Briney boring heads is simple. A bushing is mounted on preloaded balls between the driving flange and the boring bar. The hole in this bushing is eccentric with its outside diameter so that any rotation of the bushing causes a translation in the position of the boring bar. Graduations are scribed on the bushing to represent 0.00025 inch of tool movement. An eccentricity of only 0.003 inch results in a change of 0.006 inch on the radius, or 0.012 inch on the bore diameter.

Application of bearing balls has solved the problem of how to easily adjust boring tools to the correct size while retaining tool rigidity. In this head, developed by Briney Mfg. Co., the balls act as bearings while fine size adjustments are made. Since none of the adjusting parts in this assembly move during tool use, wear is not a problem. Balls are used because they can be easily preloaded during assembly and provide rigidity as a result of the preload.

With this head, the tool can be set to the high tolerance limit on the initial setting. This results in longer runs before resetting is required. Readjusting to the high limit is a simple matter of turning the adjusting bushing with a spanner. By the time the bit has worn an amount equal to the adjusting range of the bushing, it is usually replaced. The boring head is sealed against cutting fluid and particle penetration. Construction of the unit permits cutting fluid to be applied to the work through the boring bar.



BORING HEAD components assemble easily preloading the balls during assembly. Adjustments are made by turning the bushing with a spanner wrench without loosening or tightening any fastener. Because the drive is positive to the boring bar, changes in adjustment could occur during use only as a result of inertia of the bushing. To prevent bushing slippage, die springs, acting against the drive plate, hold the assembly tightly together longitudinally. Drive plates with slots and boring bars with tongued ends are used when the head is for operation in either direction of rotation

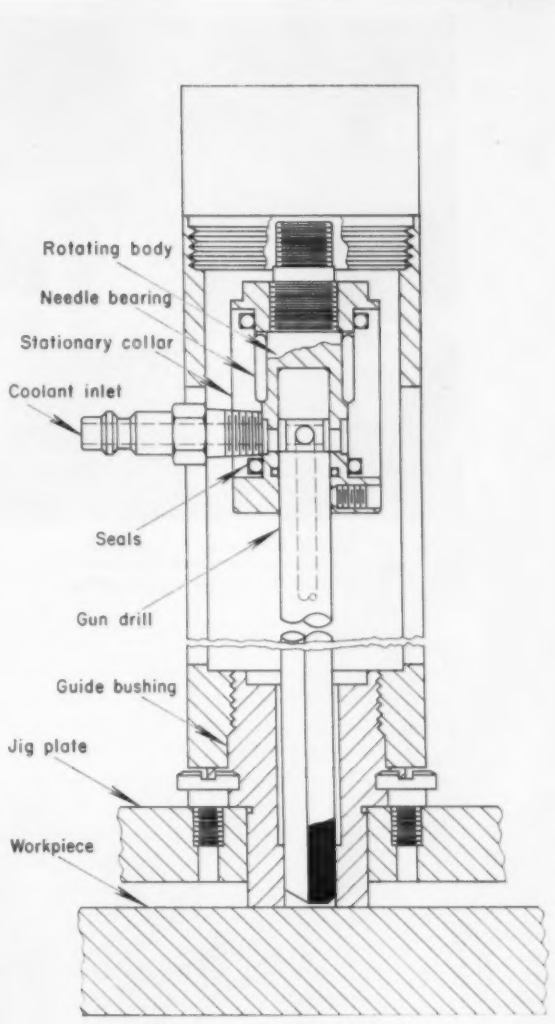
Bulky Items Drilled Without Fixtures

Positive mechanical feed for light-weight, high-torque, portable power tools provides for accurately gun drilling holes with a minimum of tooling. Developed jointly by A. B. Quackenbush Co., and National Twist Drill and Tool Co., the tool requires no special fixtures, only a simple jig plate to hold size, maintain alignment, and provide fine surface finishes on the drilled parts.

The jig plate has a bushed hole to hold the drill guide bushing, which is attached to the drill unit. After clamping the jig plate to the work, the drill guide bushing with bayonet locking grooves and pilot is inserted for drilling. When the hole is completed, the unit may be moved to another jig plate for another operation.

Mist coolant for the drilling operations is forced, under high pressure, through the fluid-tight sleeve outside the driving sleeve or chuck to the drill point through the drill body. In addition to keeping the drill cool, the cutting fluid flushes the chips from the drilled hole.

The positive feed device is adjustable by small increments dependent upon the drill diameter and the chip forming characteristics of the material being drilled. Positive feed action reduces the tendency to work harden some materials and eliminates the dulling of drill edges from idling rather than cutting in these materials.



DRILL and chuck components normal operating position.

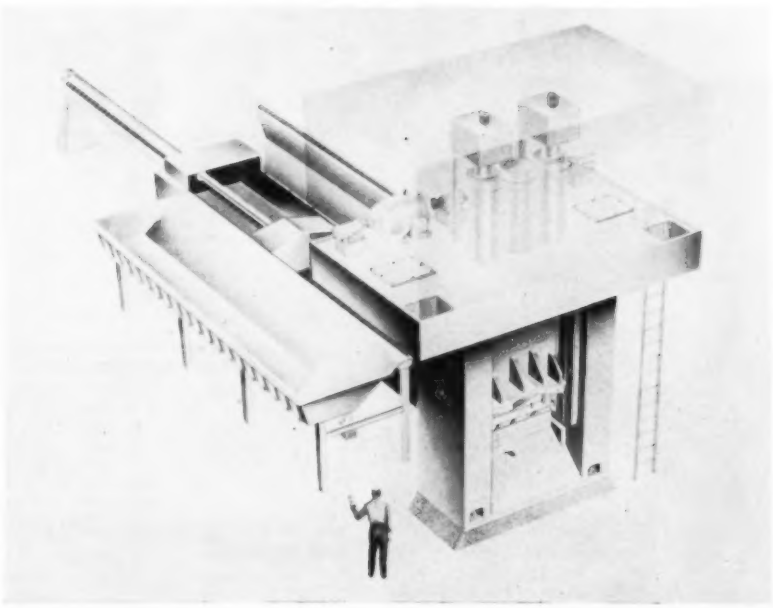
GUN DRILLING on aircraft landing gear assembly.

Scrap Shear Operates Automatically

REAR VIEW of the hydraulic scrap shear. Steel scrap can be seen entering the blade area from beneath the hold-down fingers.

Automatic 600-ton hydraulic shear, designed for full-time outdoor operation, has a 22-foot hydraulically tilting hopper and feed box. The latter houses the hydraulic ram that feeds scrap to the adjustable, heavy-duty, alloy-shear blade. The machine, built by Clearing Machine Corp., will cut almost any kind of heterogeneous scrap into equal lengths, and is adjustable in six-inch increments from 6 to 48 inches.

Operation of the unit consists of loading scrap into the hopper by crane. When the hopper is filled, the operator starts the 12-sec. cycle of elevating the hopper and dumping its contents into the charging box. The lid on the charging box closes, and the hopper returns to its original position for reloading. Shearing begins when the charging ram moves forward a preset distance, pushing the scrap under the shearing blade. A 100-ton hold-down device behind the shear blade moves down to hold scrap firmly in place during shearing. After shearing is completed for each increment, the hold-down releases, and the next cycle of the feed is repeated until the entire charge is cut.



PHANTOM drawing of the Clearing hydraulic scrap shear. The twenty-two foot long cylinder which drives the feed box ram can be seen at left. The motors, hydraulic pumps, cylinders, valves, etc., located on top of the crown are protected by a large weatherproof "house," to provide for outdoor operation.

Determining Tool Life on Nodular Cast Iron

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Comparative tests indicate effects of material hardness on tool life. Increasing free nodular graphite improves machinability markedly. Also, larger nose radii, consistent with finish, are desirable.

TO REMAIN COMPETITIVE, it is essential for certain industries to reduce machining costs, especially when these costs represent a substantial portion of the total manufacturing cost. To determine a sensible course of action in efforts to reduce machining costs machinability or tool-life data are of particular value.

This article discusses the results of a research program,[1] concerned with the machinability and heat treatment of nodular cast iron. Nodular cast iron, a relatively recent addition to the family of engineering materials, combines the mechanical properties of steel with the easy-to-cast properties of gray cast iron and is well-suited to replace these materials in many applications. In general, the machinability of nodular iron is superior to that of gray cast iron of similar hardness but of much lower strength. Nodular iron in the normalized condition has a predominantly pearlitic matrix. In the annealed condition this material has a ferritic matrix, associated with lesser hardness and strength and greater ductility.

This article is restricted mainly to considerations of machinability. The effects of variations in cutting speed, feed, workpiece material and hardness, grade of carbide, side-rake angle, and nose radius on tool life, as determined within the limits of full-time tool-life tests without a cutting liquid to 0.060-inch terminal width of flank wear, are reported. For comparison purposes, tool-life performances on malleable iron are also given. Typical photomicrographs of the workpiece materials and patterns of flank and crater wear are pictured and discussed.

Nodular Cast Irons and Carbide Tools

The nodular cast irons tested were produced to tentative German DIN-Standards or to specifications by foundries licensed by American manufacturers. A general distinction between two different grades is as follows:

1. Normalized nodular cast iron, mainly with a pearlic microstructure.
2. Annealed nodular cast iron, mainly with a ferritic microstructure.

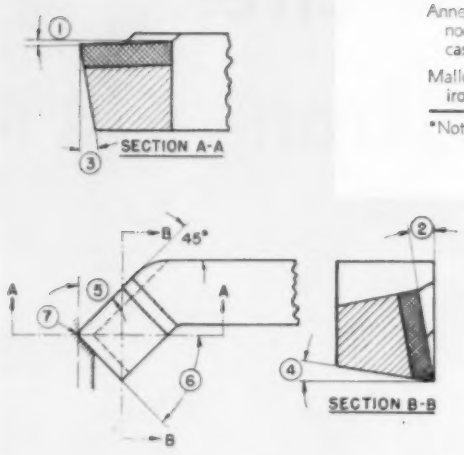
Three different foundries supplied the nodular cast irons and for comparison purposes malleable iron was also tested. The machinability test pieces were cast from the same ladle, when possible, in the form

[1]**Conducted at Daimler Benz A. G., Stuttgart-Untertürkheim, Germany, in cooperation with the faculty of machine tools and machinability at the Technical University, Stuttgart, under Prof. W. Leyensetter.**

Table 1—Workpiece Description

Material	Foundry	Hardness (Bhn)	Dimensions (inch) OD	ID	Length	No. of Pieces	Weight (lb/pc)
Normalized	A	186-219*	6	—	20	8	145
nodular	B	229-246	6	—	20	8	145
cast iron	C	224-239	6	4.4	18	10	60
Annealed	A	150-234	6	—	20	7	145
nodular	B	180-229	6	—	20	8	145
cast iron	C	156-177	6	4.4	18	10	60
Malleable iron	C	110-140	6	4.4	18	10	60

*Not within prescribed hardness limits of 230-280 Bhn



Tool Nomenclature

1. Back Rake Angle
2. Side Rake Angle
3. End Relief Angle
4. Side Relief Angle
5. End Cutting Edge Angle
6. Side Cutting Edge Angle
7. Nose Radius

Fig. 1. Tool geometry and designation of the angles on a turning tool.

of bars and tubes. Workpiece characteristics are listed in TABLE 1.

Single-point carbide tools corresponding to the German standards DIN 4952 were used. Right-hand tools had a shank cross section of 1 x 0.59 inch and the cutting end was bent 45 degrees to the left in a forging operation, *Fig.* 1. Carbide tips of the following grades were brazed to the shanks:

H1—for cast iron above 250 Bhn and high-tensile-strength steel, approximately class C-2 or C-3;

TT2—for steel at medium feeds and speeds, approximately class C-6;

TT3—for steel roughing cuts, approximately class C-5 or C-50;

AT—general purpose carbide for steels and cast irons tending to cause pronounced tool cratering; and

STil—for precision turning of steel at high speeds, approximately class C-7 or C-8.

Test Equipment

Turning tests were carried out on a 20-inch VDF, V3K engine lathe with a 6.5-hp PIV variable speed drive; the speed range of 10 to 800 rpm was covered. The speed was measured directly at the spindle during the cut with a Hassler instrument. The feed was adjustable from 0.004 to 0.080 ipr. An additional dial gage on the cross slide was used to set the actual depth of cut accurately. At high speeds a shield above the single-point tool was used to protect the operator from the spray of flying chips.

In most cases the tools were ground to a shape of 0, 6, 8, 8.5, 45, 45, 0.040 and 0.020 with a metal-bonded diamond cup wheel of about 180 grit with a tolerance of ±0.5 degree.

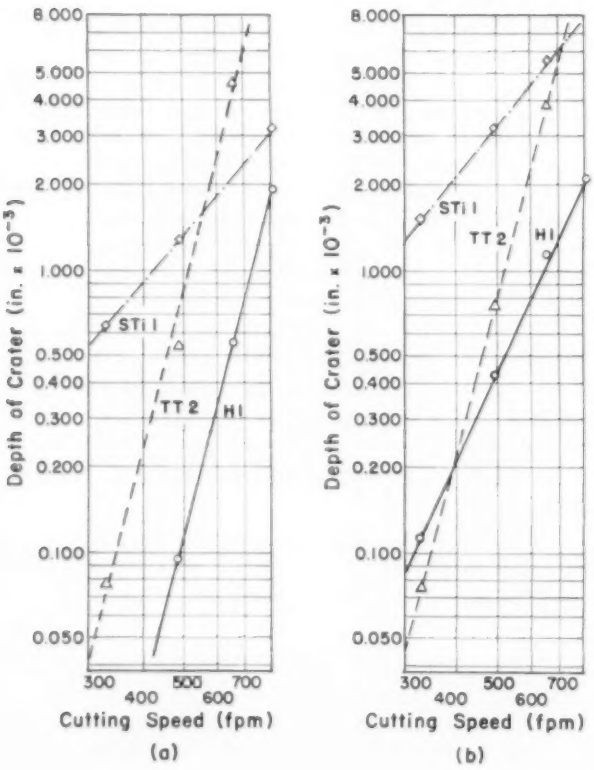


Fig. 2. Influence of cutting speed on crater wear for three carbide grades when machining annealed nodular cast iron, 150-180 Bhn. Feed, 0.006 ipr; depth of cut, 0.060 inch. Chart (a) is for 1640 ft of tool travel and Chart (b) is for 3280 ft length of tool travel relative to workpiece surface.

Test Procedure

Preliminary cuts were taken on the test bars and tubes to remove the rough skin in order to eliminate the effects of this variable factor from the tests.

Data was gathered to provide a possible correlation between tool wear and length of tool travel, considering especially the relationship of flank wear to depth of crater when turning predetermined lengths of 160, 320, 640, 1640 and 3280 feet. Width of wear on the flank and maximum depth of crater were measured.

Ordinary full-time tool-life tests, without a cutting fluid, were made to obtain an accurate measure of machinability. In general, proposed or existing American and German standards for turning tool-life tests are similar for all practical purposes. The following German specifications may be of special interest. Tool angles must be ground within a tolerance of ± 1 degree. A 0.004-inch wide face or land must be lapped or honed on the cutting edge at an angle of approximately 45 degrees to the direction of the cutting velocity and the roughness of this land must not exceed 5 microns (average). The tool and toolholder must be very rigid and the length of the unsupported end of the tool shank should not exceed the height of the shank.

In the initial series of cutting tests it was found that surface finish conditions of the workpiece could also be used as a criterion for the termination of tool life. In semifinishing cuts, constituting a majority of the tests, a sudden visible increase in workpiece diameter of about 0.004 inch occurred when an approximately 0.060-inch width of flank wear had been reached. Since wear measurements of carbide tips, taken when different types of slight tool breakdown had occurred, usually indicated about 0.060-inch width of flank wear and 0.006 to 0.010-inch depth of crater wear, this degree of flank wear was chosen as a terminal wear criterion. This selection was made also because of the prevalence of rapid crater wear especially at high speeds and because it minimized the quantity of test material required, time consumed in testing and tool regrinding expense. In full-time tool-life tests, termination of tool life was signified when one or more of the following occurred:

1. Notching of the tool nose accompanied by a sudden increase in the power required or a sudden increase of the workpiece diameter.
2. Increase of flank wear up to 0.060 inch in addition to notches, which also increased the power required.
3. Light sparking.
4. Breaking of the cutting edge.

The majority of tool-life tests was conducted at a feed of 0.012 ipr, and a depth of cut of 0.060 inch or at a ratio of depth to feed of 5:1. According to general experience, the influence of the depth of cut on the tool life can be considered negligible when the ratio of depth to feed is greater than 4:1.

Minimum stiffness and rigidity of the workpiece were guaranteed in these tests by never exceeding a ratio of 7:1 between length of test bar and minimum machined diameter.

The initial series of tests led also to the selection of the range of cutting speeds from 346 to 820 fpm. The low speed range, at which the greatest amount of material and time is consumed, was selected in most cases in such a way that a tool life of 40 to 100 min was anticipated. In a few cases tool life was as great as 300 min and such points fell on the extension of the straight tool-life curve plotted in log-log coordinates.

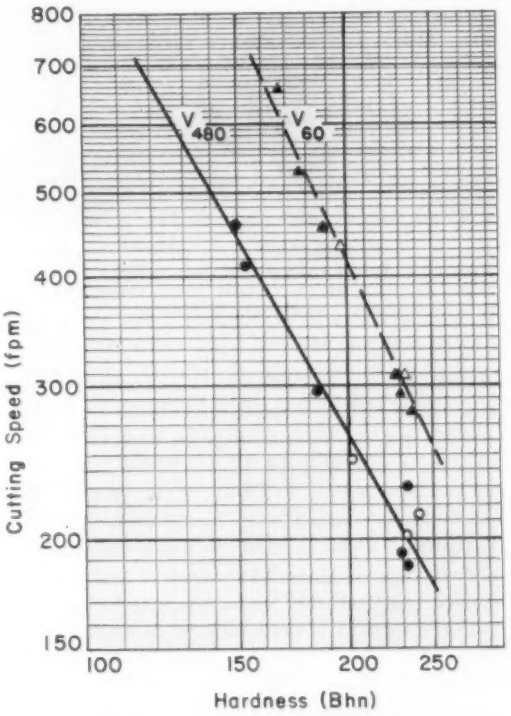


Fig. 3. Relation of Brinell hardness to cutting speeds for tool life of 60 and 480 min. Workpiece material, nodular cast iron; carbide grades, H1 (black data points) and AT (white data points); feed 0.012 ipr; depth of cut, 0.060 inch.

Test Results

Correlation between the length of tool travel and tool wear was sought considering especially the relationship of flank wear to depth of crater when turning predetermined lengths of 160, 320, 640, 1640 and 3280 feet. Width of flank wear and depth of crater for three carbide grades were measured and the results plotted in *Fig.* 2 for lengths of 1640

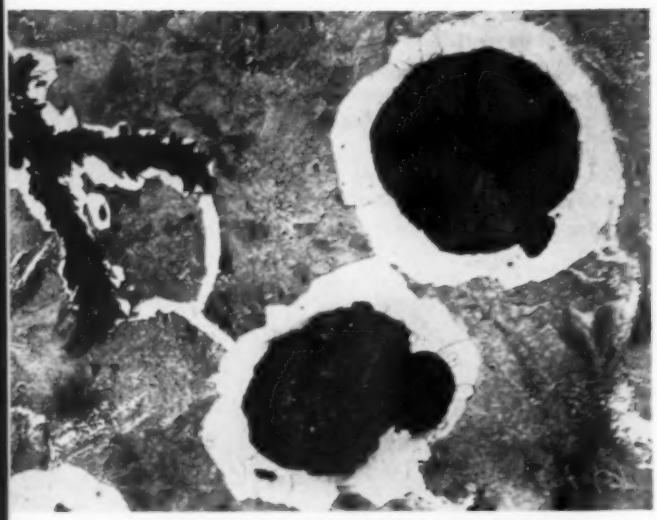


Fig. 4. Photomicrograph of normalized nodular cast iron is a typical example of spheroidal-shaped and flake graphite within ferritic halos embedded in a pearlitic matrix. Nital etch, X 200.

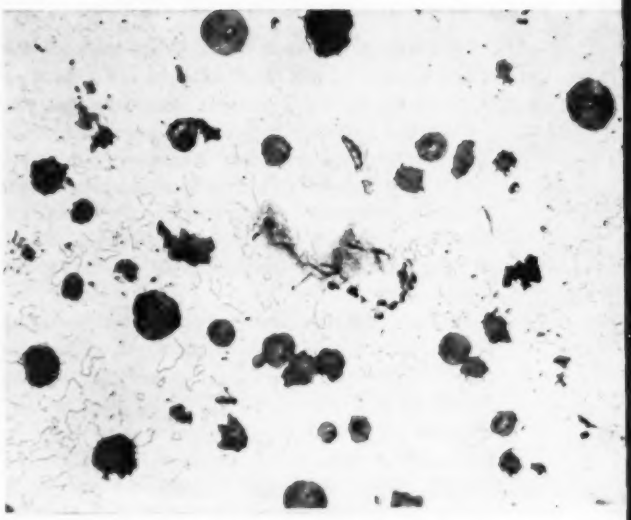


Fig. 5. Photomicrograph of annealed nodular cast iron, nital etch X 100 shows spheroidal graphite in a ferritic matrix having little lamellar pearlite and some not quite spheroidally transformed graphite.

and 3280 feet, respectively. These comparatively short tests give only qualitative results concerning carbide grades, crater wear being most sensitive to changes in cutting speed for the carbide represented by the steepest line. For both lengths of tool travel grade H1 performed best. Grade STil, exhibiting the greatest depth of crater, was considered unsuitable for machining nodular cast iron and this conclusion was confirmed in further tests.

For evaluation of the total wear picture there are essentially three values required: width of flank wear, depth of crater, and distance from the crater center line to the cutting edge. Flank wear increases with an increase in cutting speed at greater than a linear rate. Of particular interest and practical significance is the effect of cutting speed and feed on both crater and flank wear. Exploratory turning tests showed that, with an increase in either the cutting speed or feed, the depth of crater wear increased. At high speed and feeds crater wear was substantially as important as, if not more critical than, flank wear. To determine how far tool wear could be extended, tests with variable cutting speed and feed were continued until the cutting edge failed. In all of the tests an average width of 0.060 inch flank wear proved to be, and was established as a satisfactory tool-life terminal point.

It was found, and it should be emphasized, that

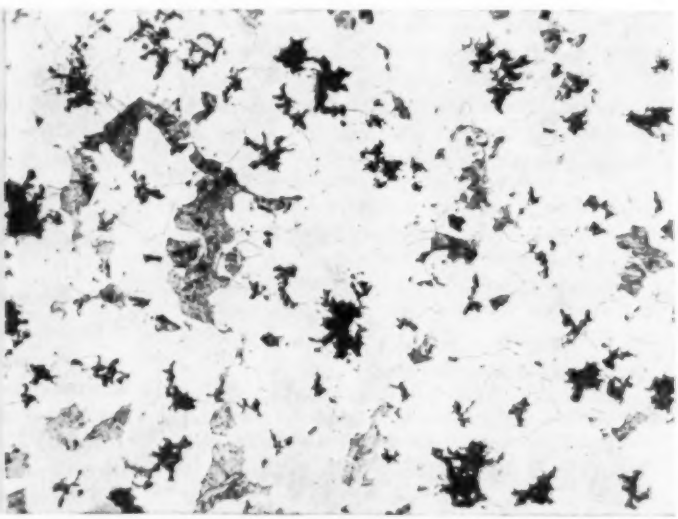


Fig. 6. Photomicrograph of malleable iron nital etch, X 100 shows temper carbon in a ferritic matrix with about 10 percent pearlitic structure.

Brinell hardness, and thus the microstructure of nodular cast iron, had a great influence on machinability. With increased tensile strength or Brinell hardness, cutting speed for a specified tool life decreased rapidly as shown in *Fig.* 3. The V_{60} value of 600 fpm for 170-Bhn nodular cast iron was reduced to 375 fpm by an increase in hardness to 210 Bhn. This comparison illustrates the importance of Brinell hardness of nodular cast iron relative to good machinability.

The machinability of nodular cast iron is improved with increasing content of free nodular graphite which is associated with a decrease in hardness. As soon as the tool enters the workpiece, plastic deformation occurs and chips are sheared off. When graphite spherules are sliced by the cutting tool and partially disengaged from the ball-shaped cavity, free graphite is drawn into the chip flow. The graphite particles, because of their antifriction properties, improve the sliding action between the chip and the tool. In this case the nodular graphite acts in a fashion similar to that of lead and sulphur in free-machining steels.

Observations of the nital-etched specimens for each group of cast iron indicated some difference in microstructure and composition, *Figs.* 4, 5 and 6. Not all specimens of normalized nodular cast irons showed the same pattern of pearlitic microstructure. In the annealed form differences also were noticeable within the ferritic matrix.

Cutting-speed tool-life relations for comparison of the materials, furnished by different foundries, are shown in *Figs.* 7 and 8. Workpieces from Foundry C showed the best machining characteristics, primarily because they were more uniformly annealed. Tool life would have been still better had the test bars not contained blowholes. Foundry B showed somewhat lower tool life, even though the material was within the prescribed hardness limits. This might have been due to the composition and structure of the casting. Normalized cast iron from Foundry A was not tested extensively since the structure and hardness did not come within the prescribed limits. Malleable iron from Foundry C was uniform in hardness and had good machinability.

Comparisons of carbide grades H1, AT, TT2 and STil on annealed and on normalized nodular cast iron are shown in *Figs.* 9 and 10. Carbide grades H1 and AT were found suitable for the machining of annealed nodular iron. In spite of its sensitivity to interrupted cuts, H1 had the greater tool life. Due to short and erratic tool life, TT2 was considered unsuitable.

Carbide grade H1 was found to be about 14 percent less effective than AT in turning normalized nodular iron. This can be attributed to the higher resistance to breakage and lower sensitivity to interrupted cuts of the AT grade. Types TT2 and STil were less suitable and, thus, the indications obtained in preliminary tests were confirmed.

The V_{60} or V_{480} cutting speed decreased when feed was increased, all other cutting conditions re-

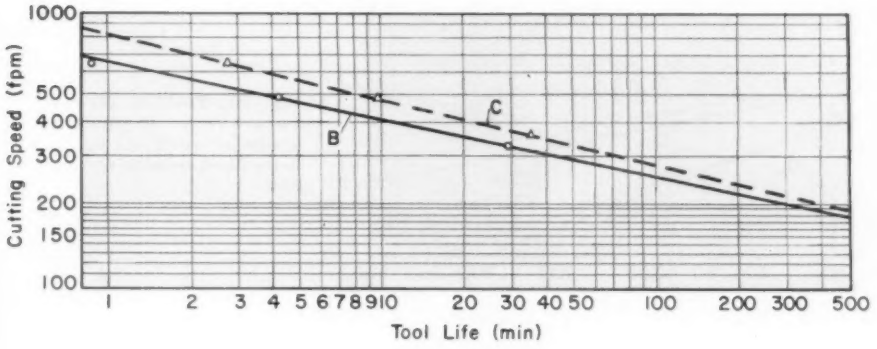


Fig. 7. Cutting-speed tool-life relations for normalized nodular cast irons from Foundries B and C. Feed, 0.012 ipr; depth of cut, 0.060 inch; carbide grade, H1.

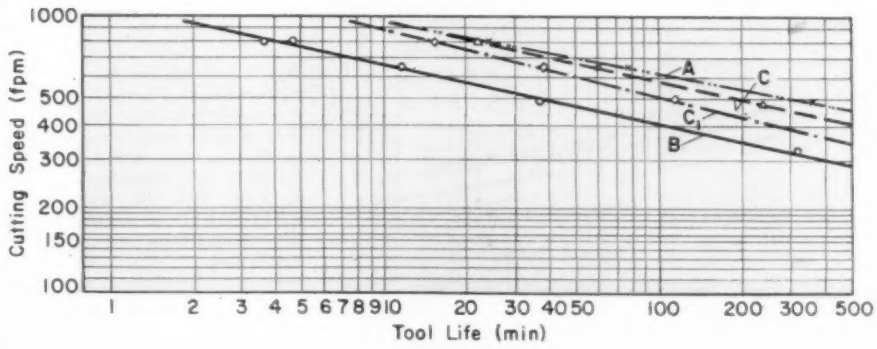


Fig. 8. Tool-life performances for malleable and annealed nodular irons. Curves are identified by foundry. Curve C_1 is for malleable iron. Feed, 0.012 ipr; depth of cut, 0.060 inch; carbide grade, H1.

maining the same, *Fig.* 11. Surface finish of the workpiece was satisfactory for feeds between 0.006 and 0.012 ipr, and became inferior for greater values of feeds. Considering tool life in terms of metal removed, rather than time consumed or production cost, it is interesting to note in TABLE 2 that at V_{480} cutting speed, 473 cu in was removed with 0.006-ipr feed, whereas 1262 cu in, almost three times as much, was removed with 0.024-ipr feed.

With a change in back-rake angle from 0 to –3 degrees and in side-rake angle from 6 to 3 degrees, V_{480} increased roughly 27 percent from 165 to 210 fpm. Greater negative rake angles were not used since they required more power than was available in the test lathe.

A decrease in side-cutting edge angle from 45 to 30 degrees, when turning normalized nodular iron, was accompanied by a reduction in V_{60} of 10 to 15 percent, as shown in *Fig.* 12.

The influence of nose radius upon tool life is shown in *Fig.* 13. A decrease of the nose radius from 0.040 to 0.020 inch caused the V_{480} value to decrease about 32 percent. It is, therefore, advisable to make the nose radius as large as surface finish requirements will permit. It is much more difficult to obtain qualitative results in turning rough castings and, hence, no exact tool-life values could be determined for them. However, under unfavorable cutting conditions such as variable depth of cut, interrupted cuts, and heavy feeds, the recommended

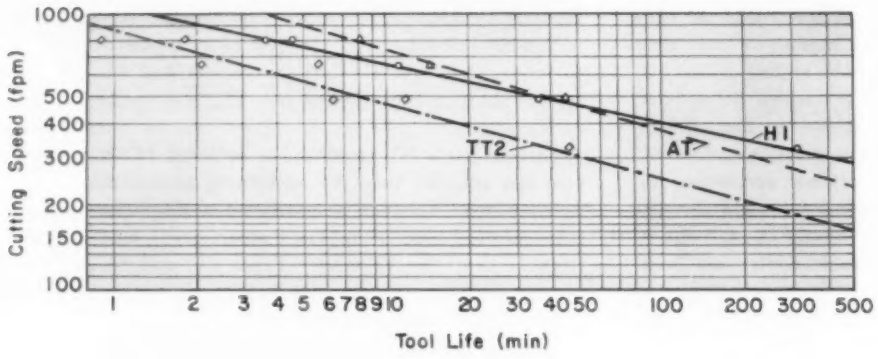


Fig. 9. Tool-life performances of three grades of carbide on annealed nodular cast iron. Carbide grades—AT, H1, and TT2; workpiece material—Foundry B, 180-202 Bhn (not quite within prescribed hardness limits); feed, 0.012 ipr; depth of cut, 0.060 inch.

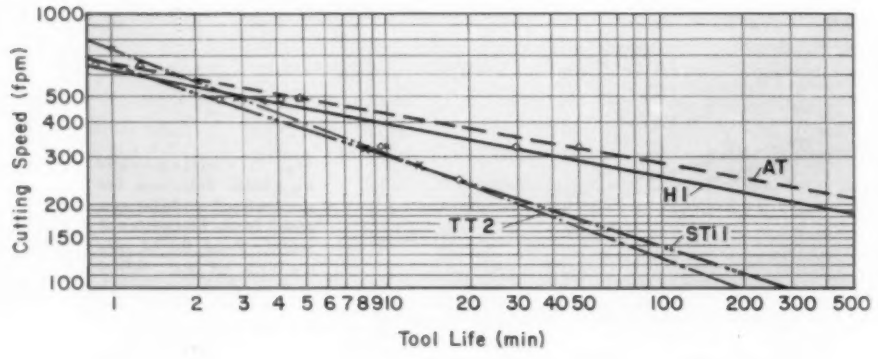


Fig. 10. Tool-life performances of four grades of carbide on normalized nodular cast iron.

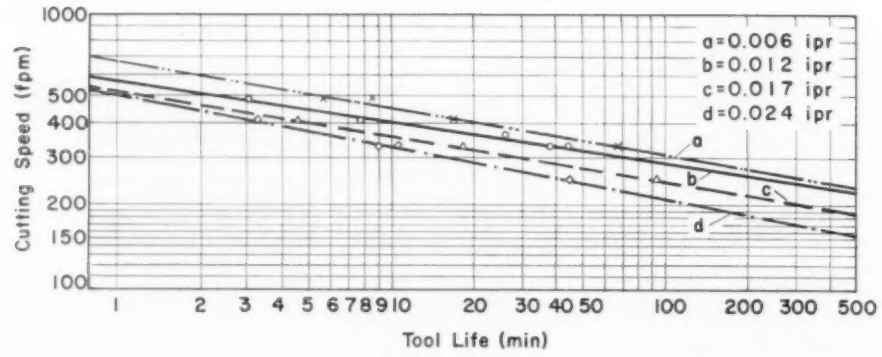


Fig. 11. Tool-life performances at four different feeds on normalized nodular cast iron, machining with carbide H1 and tool signature, 3, 3, 8, 8.5, 45, 45, 0.040 inch; and width of terminal flank wear, 0.060 inch.

grade TT3 performed well.

Whether chip flow was free or restricted, the type of chip formation was characteristic of the workpiece material. In all of the tests, unrestricted chip flow was maintained. When turning normalized nodular iron, the chips were mostly discontinuous small spirals. However, some were needle-like, especially at high speeds. With annealed nodular iron, the chips were continuous in the form of long or irregular spirals, except that at high speeds they were discontinuous and needle-like. The dust accompanying dry cutting was annoying and a dust collector should be provided to protect the operator and the machine, and improve working conditions generally.

Preliminary turning tests did not lead to a short-time tool-life test procedure which would permit reliable predictions of longer tool-life periods. Qualitative results concerning the machinability of the materials and carbide grades tested and a criterion of permissible terminal flank wear were obtained from these tests.

In turning nodular cast iron, greater depths of cut and higher cutting speeds and feeds from the tool-life viewpoint can be applied than in turning gray cast iron. Power and rigidity requirements of the machine tool for the indicated increased metal-removal rates are, therefore, also higher and should be considered when designing or selecting equipment to machine nodular cast iron materials.

Table 2—Tool Life vs. Metal Removed
(for normalized nodular cast iron and carbide grade H1)

Feed (ipr)	Cutting Speed (fpm) V_{60}	V_{240}	V_{480}	Metal Removed (cu in) V_{60}	V_{240}	V_{480}
0.006	340	270	345	84	267	473
0.012	308	255	225	157	502	909
0.017	268	208	188	189	591	1050
0.024	230	177	155	236	719	1262

Depth of Cut: 0.060 in.
Tool signature: –3, 3, 8, 8.5, 45, 45, 0.040 in.
Width of terminal flank wear: 0.060 in.

Particular attention must be paid, especially by foundries and heat-treatment departments, to the hardness of nodular irons then, since it is evident that small variations in hardness can cause great changes in tool life. In comparative tests with malleable iron, V_{60} values were 20 to 25 percent higher for annealed nodular iron. Microstructure, Brinell hardness and machinability varied considerably among the nodular cast irons tested; for example, the ratio between the best and worst tool life in minutes for any given cutting speed was at least 5:1 for the annealed nodular irons. Comparative tests of carbides used in turning nodular iron showed grades AT and H1 to be superior.

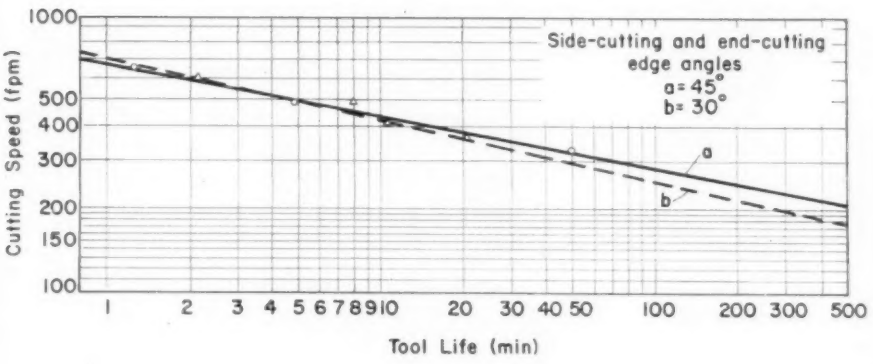


Fig. 12. Tool-life performances of two different side-cutting-edge angles on normalized nodular cast iron. Side and end-cutting-edge angles: a-45 deg; b-30 deg. Other tool angles are standard. Carbide grade, AT.

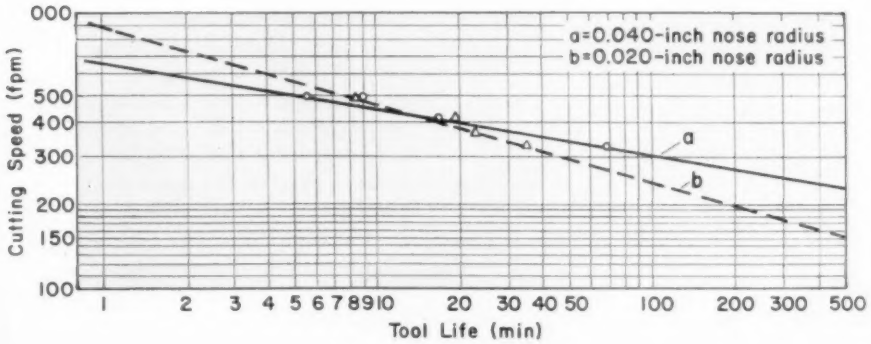


Fig. 13. Tool-life performances of two different nose radii on normalized nodular cast iron. Carbide grade, H1; feed, 0.006 ipr; depth of cut, 0.060 inch; tool signature, –3, 3, 8, 8.5, 45, 45, a or b.

ASTE SURVEYS NUMERICAL CONTROL

MOST TOOL ENGINEERS are interested in numerically controlled machine tools but, at the moment, few tool engineers are making serious studies of potential applications in their own plant. Those are the conclusions drawn from a survey of hundreds of top tool engineers by ASTE.

The survey shows that before tool engineers can evaluate the application of numerically controlled machine tools to their own tooling programs, they need to know what kinds of equipment are available and what types of equipment are most practical for applications in their plants. Other questions are:

- Can present machine tools be converted to numerical control?
- How much does it cost to prepare program tapes or punched cards?
- Will specially trained technicians be needed?
- If so, who will train them?
- What will equipment and development costs be?
- What savings can be expected in direct labor, scrap, indirect labor and lead time?

With respect to existing numerical control installations, tool engineers want to know what problems were encountered and how they were solved. On what basis was the economic desirability of numerically controlled equipment determined? What specific benefits were realized?

Tool engineers also need information on how to convert a blueprint or drawing into numerical data. Similarly, they want more information on digital and analog systems—the desirable features and faults of each.

The fact that the tool engineers surveyed asked specific questions and demanded specific answers is a strong indication of the high interest in numerical control. Despite the lack of detailed knowledge, survey findings indicate that industry will spend over a half-billion dollars for numerically controlled equipment during the next five years.

Study of the survey results shows that larger plants (employing 10,000 or more workers) have done more pioneering work in adopting numerical control than smaller plants. Of those large plants already using programmed machine tools, most are engaged in the manufacture of aircraft.

Regardless of the size of their plants, the majority of tool engineers surveyed believe that drilling is the process most adaptable to numerical control. Those tool engineers who already have tape or punched card-controlled equipment in operation in their plants, however, list jig boring, milling and riveting as the predominant applications.

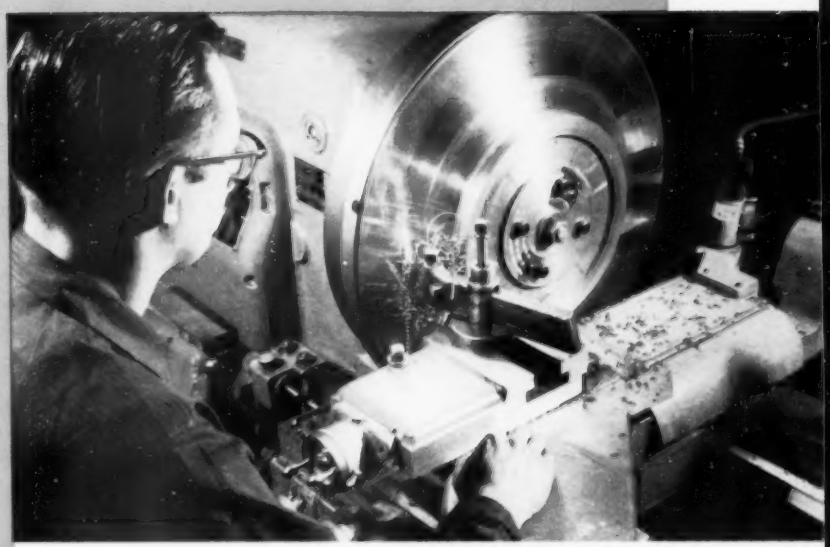
Savings in direct labor appear to be the most important single factor considered by tool engineers who are considering the adoption of numerical control systems. Savings in machine time, improved accuracy and reduction in equipment requirements are considered to be secondary, but still important.

Short-run production schedules are regarded as the area where numerical controls can be most profitably applied. Decreased lead times and lower fixture costs are frequently mentioned as important advantages.

In response to the question "What future developments in numerical controls would accelerate their adoption in your plant?" most engineers replied—in substance—"The cost is too high—the systems are too complicated and not standardized—we need to know a lot more about them—and anything that can be done to obviate these difficulties will hasten the adoption of numerical control in our plants."

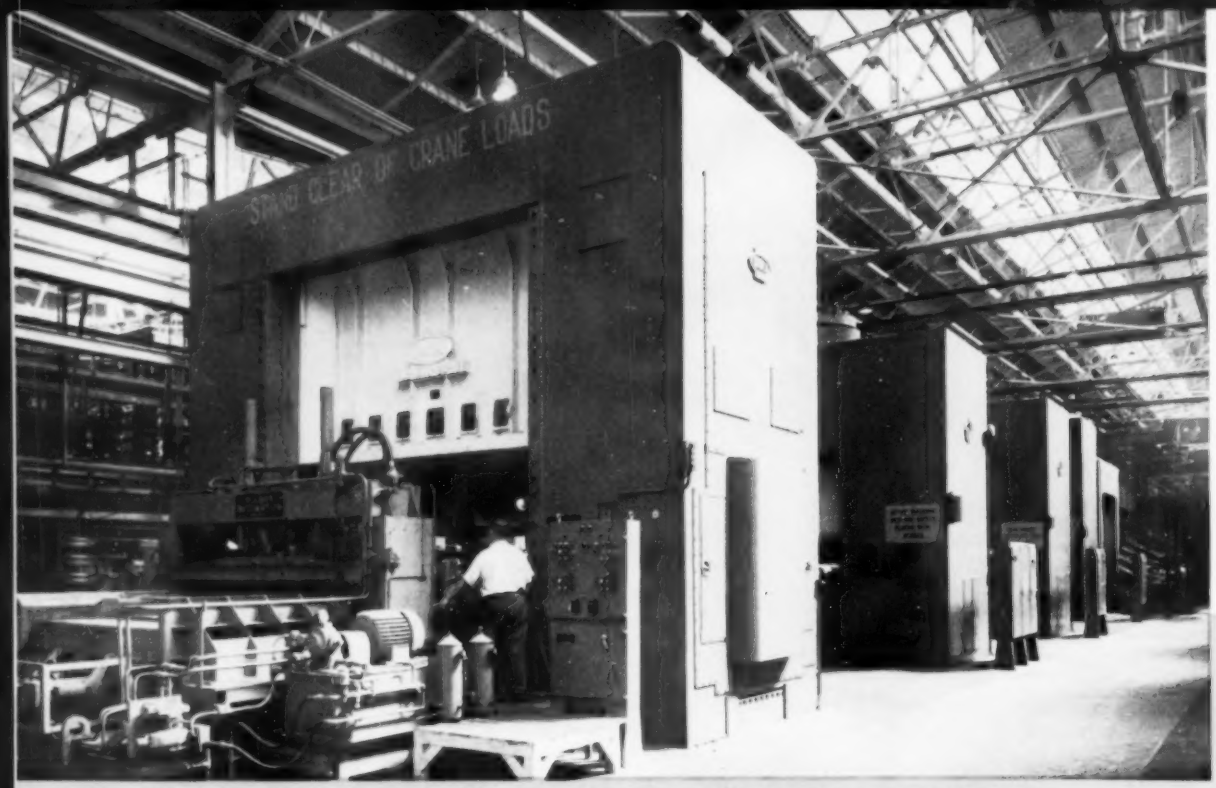
Answers to the survey questions make it apparent that, while programmed machine tools may be a road to lower costs for the small shop, the short-run and custom jobber, and the low-production manufacturer, a great deal of educational effort must be expended by machine tool and control builders, professional engineering societies and technical magazines, before the real potentials of numerical controls will be fully exploited.

TOOLS at work

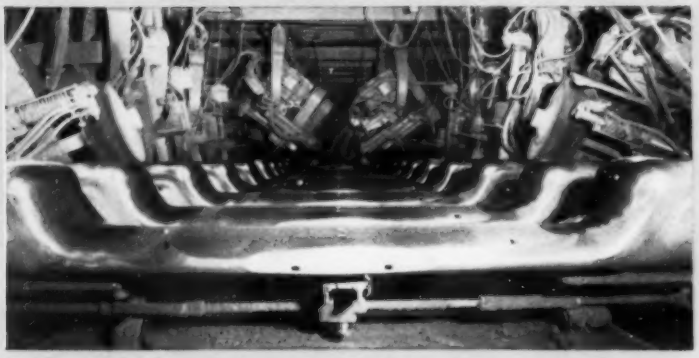


STEEL FORGING for 21-inch-diameter turbocharger cover is mounted in special holding fixture to prevent deflection during machining. Specifications for the 7/64-inch-thick workpiece call for a minimum 32-microinch-rms finish and contour accuracy of 0.005 inch. Both are obtained with carbide tooling, using an air-gage tracer equipped Monarch lathe. Covers are manufactured by Delta Industries.

MISSILE HEAD component of tough, high-temperature alloy steel is precision contour bored on tracer machining setup at Diversey Engineering Co. Typical of the accuracy demanded on much of today's missile hardware, this workpiece is machined to tolerances of +0.001 —0.000 inch while achieving a surface finish of better than 20 microinches. Carbide tooling and air-gage tracer equipment are used on the Monarch swing lathe.



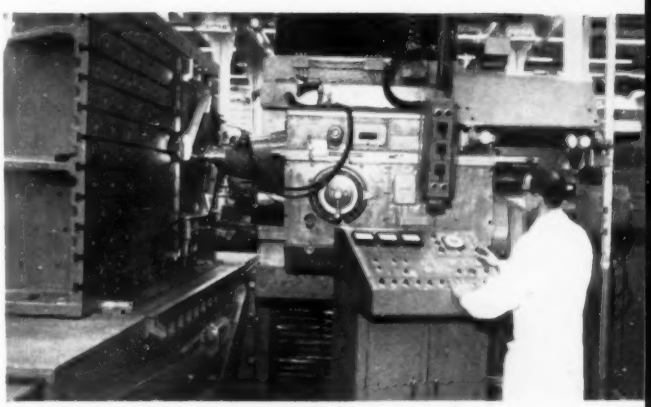
NEW FACILITIES for manufacturing bumpers at the Monroe plant of the Ford Motor Co. are almost fully automated. Bumpers are formed, two at a time, on this stamping line. Mechanical handling devices move bumpers from press to press. At the end of the line, bumpers are separated and trimmed. Production capacity of the line is 600 units per hour.



PRIOR TO PLATING, bumpers are loaded onto a conveyor table that carries them through polishing machines. The four polishing machines move bumpers through jet streams of abrasive and under scores of buffing wheels at the rate of 500 pieces per hour.

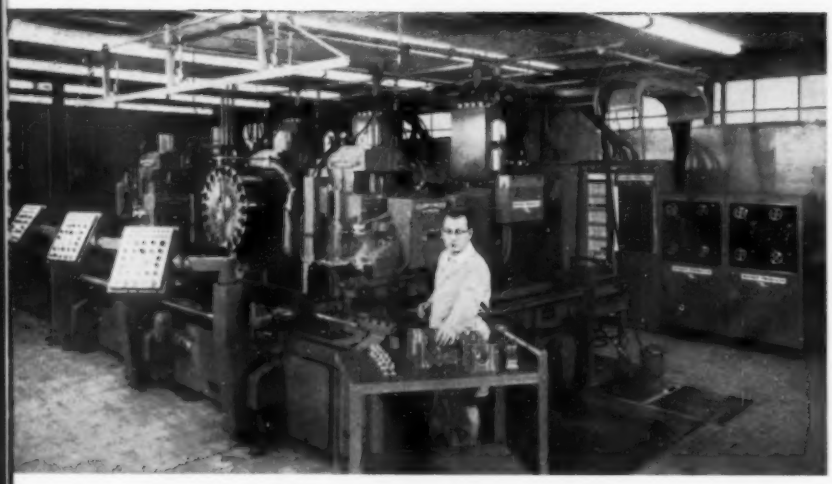
AFTER POLISHING, bumpers are placed in racks for plating. Each of the two plating machines is over 700 feet in length. Bumpers are plated with copper, white brass, nickel and chromium. The white brass facilitates uniform plating distribution on the compound shapes of wrap-around bumpers.

DEBURRING AND GENERATING RADII on small parts (inset) is accomplished through a combination of rotary and vibratory action on Elliott Vibraslide finishing barrel. As barrel rotates at 4 rpm, the barrel, media and parts are vibrated at 2300 cycles per minute. Vibrating action makes it possible to finish part areas that are shielded from abrasive action when rotary movement alone is used. Vibration also accelerates the finishing action. About 2000 parts are finished in a 1½-hour cycle. Loading is facilitated by use of hoist pan. Operation is at Metal Finish, Inc.

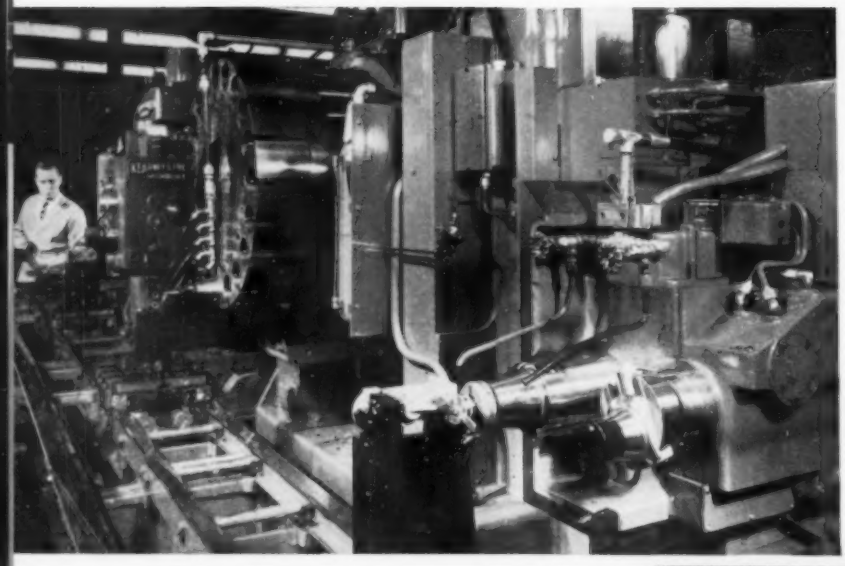


COMPLEX AIRCRAFT PART is machined on a numerically controlled Kearney & Trecker milling machine at The Martin Co., Baltimore, Md. The machine can mill one part in two hours instead of eight hours as required by conventional machine. Positioning tests show that the free running spindle can cross the entire 10 by 4-foot work surface diagonally and return to within 0.001 inch of the starting point. This indicates that with tools having sufficient rigidity, workpiece tolerances within 0.001 or 0.002 inch can reasonably be expected.

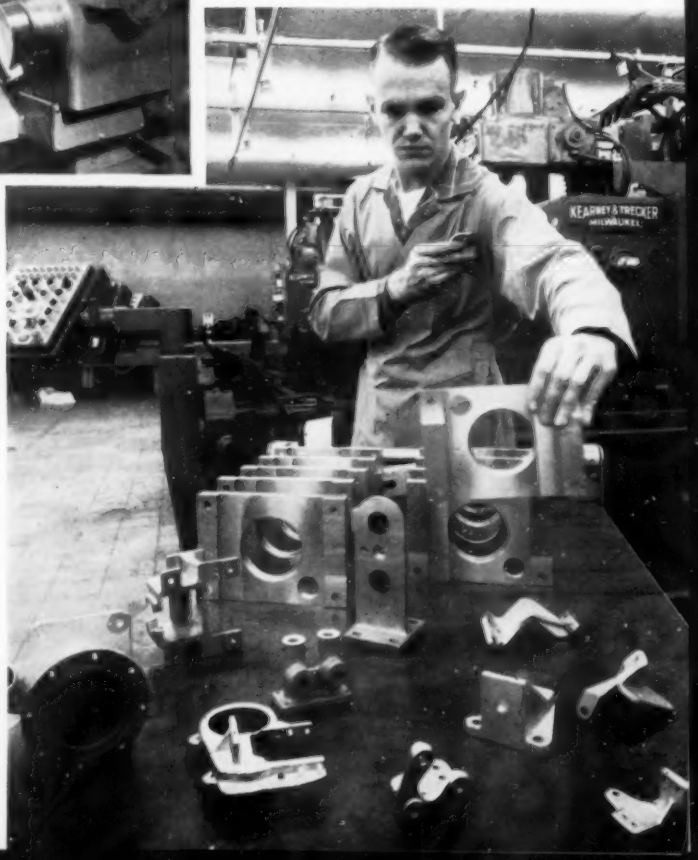
TOOLS at work



TWO SYMBOLS of automation—automatic workhandling and numerical control—have been combined on this machining line developed by Hughes Aircraft Co. in cooperation with Kearney and Trecker Corp. Tape-operated milling, drilling and boring machines, linked by a conveyor, make possible "Detroit type" production techniques for small job lots which constitute most of the machining done by American industry.



THREE different parts pass down the tape-controlled machining line simultaneously. Operator has only to feed a casting to the line and remove the finished part when it has been machined. This makes it possible to utilize machine time to the fullest practicable extent.



TOOLS at work

ALL OF THESE sample parts can be machined simultaneously on the Hughes numerically controlled machining line. Operator has just removed a part for an electronic armament control system used in Air Force interceptor airplanes. By cutting time between the blueprint stage and production, the automated line can speed up "crash" development programs like those for guided missiles.

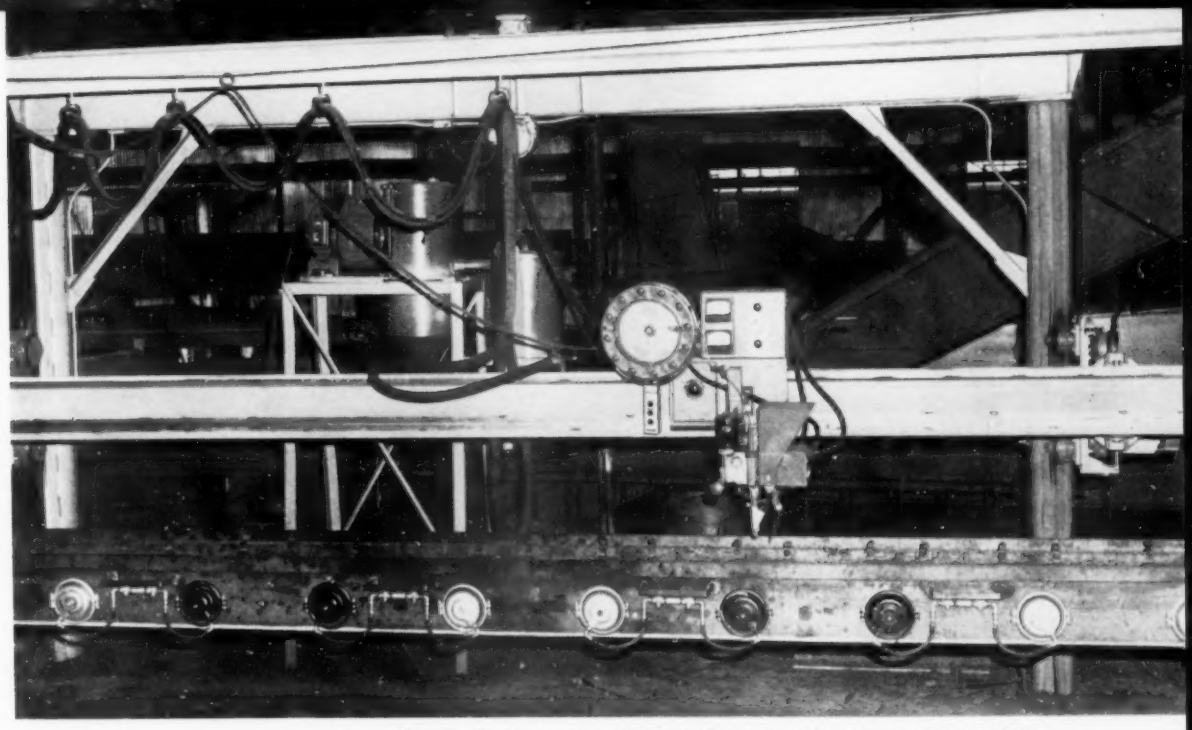


Fig. 1. Gantry type manipulator for automatic submerged arc welding, showing welding carriage. Booms at each end may be traversed in or out independently to give angular displacement of rail.

GANTRY MACHINE facilitates seam welding*

By Harry S. Powell

Production Manager
Pittsburgh-Des Moines Steel Co.
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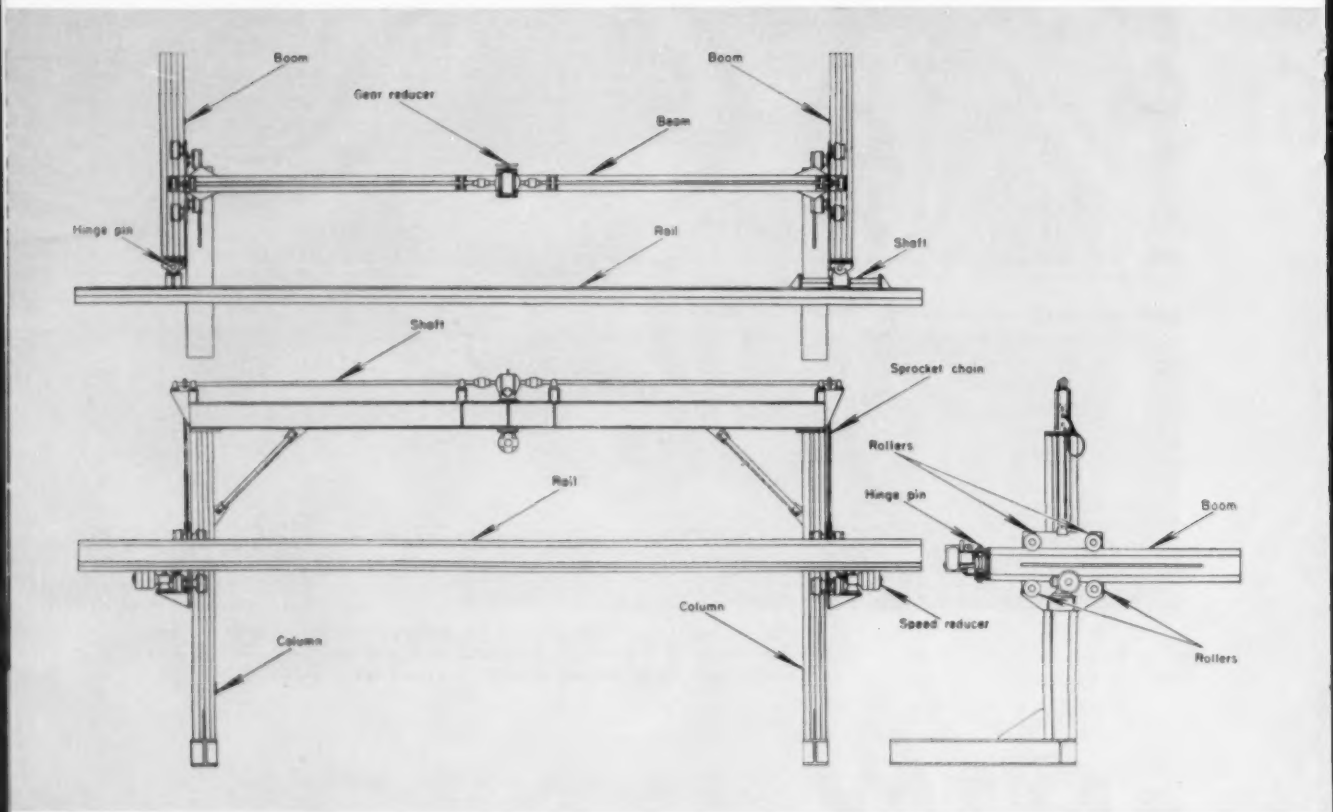
***Based on an award-winning paper in the James F. Lincoln Arc Welding Foundation Machine Design Competition.**

TO PRODUCE WELDMENTS with extremely long seams on an economical basis, the special welder illustrated in *Fig.* 1, was designed to use standard mill shapes and commercial parts. Custom-made welding manipulators are available for such work but are expensive and complicated in design. In considering the problem of building suitable equipment it was decided that a modified gantry type manipulator would handle the job and could be assembled at moderate cost.

Among the other reasons for this choice, in addition to cost, were: (1) versatility of the unit for a variety of welding on irregular shapes requiring long seams; (2) availability of materials such as wide flange beams, pipe, gusset plates, etc.; (3) minimum of machined parts, with no machining of ways or rails required; and (4) adaptability of modified automotive parts and other standard components.

Such a machine differs from conventional types because the rail carrying the welding head is not



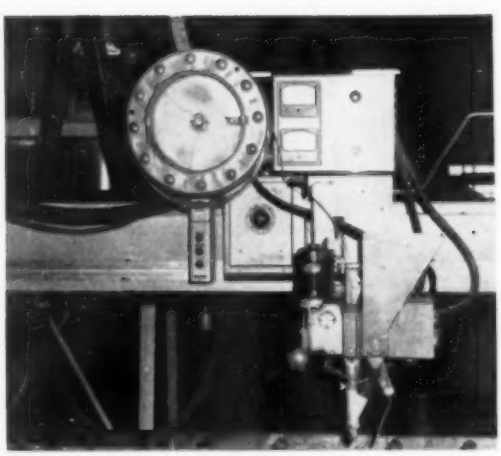


Fig. 2. (above) Details of welding manipulator. The boom and hinge construction allows the rail to be displaced in either direction.

Fig. 3. (left) Close-up of submerged-arc welding head, controls and rail mounting. Flux pickup unit is located behind the unit.

fixed to the end columns but is capable of lateral angular adjustment. This makes it possible to weld in one direction and, by pushbutton control, to change the direction of the rail, to angle in or out, without having to move the work or to reset the speed of the head.

The general arrangement of components on the welding manipulator is shown in *Fig.* 2. Columns are standard black pipe, set 20 feet apart, to which are welded angle rails for boom-saddle travel. The welds are intermittent, 4 inches long on 10-inch centers, with the angles being placed diametrically opposite each other. Base of the column is welded to a wide flange beam, reinforced by a gusset plate. Tops of the columns are tied together by a similar beam, mounting the mechanism to control vertical travel of the booms. Knee braces at each end insure rigidity.

Boom saddles are $\frac{3}{4}$-inch plate upon which are mounted the roller assemblies for vertical travel on the columns and for in-and-out movements of the booms. The booms are also pipe, with welded-on angle track rails for horizontal movement.

The roller assembly is fabricated from an automotive front wheel spindle, turned and plug welded into a 6-inch-square plate. This plate, in turn, is

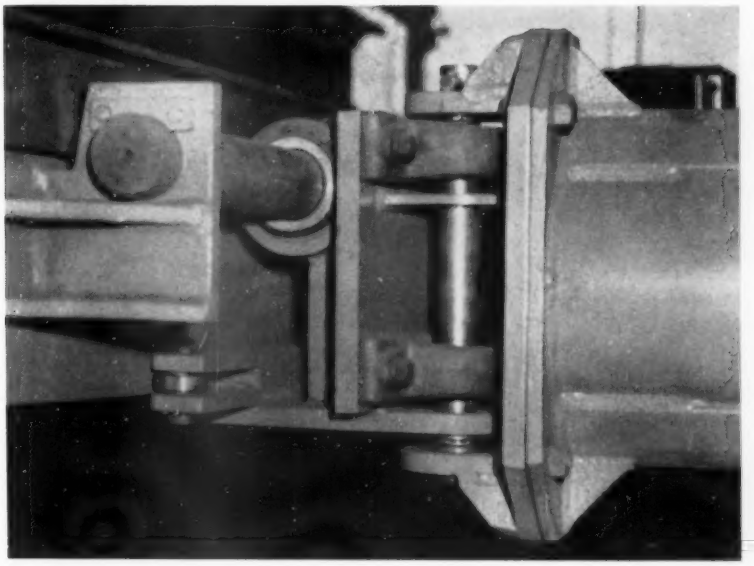


Fig. 4. Sliding hinge assembly required on one boom to allow the rail to be moved in or out a greater distance at one end than at the other. Rollers along the lower edge of the rail hold it square with the boom and hinge pin.

attached to the large saddle plate. Three of the four roller assemblies, on each side of the main saddle plate, are adjustable for alignment purposes. Rollers are machined with a 90-deg groove to travel the angle iron rails. On the opposite side of the saddle, four other rollers are positioned to accommodate the boom for lateral movement.

One end of the boom is fitted and welded to a mounting plate carrying a hinge pin assembly, attached to a standard rail assembly, on which rides a standard submerged-arc welding head. The boom at either side may be traversed a total distance of 6 feet, thereby permitting the rail to be positioned at any angle from parallel to 25½ deg, in or out at either end.

The rail is built from channel iron, boxed and intermittently welded. Along the top are cold-rolled flat bars to accommodate the rollers of the welding head, thereby eliminating all machining on the rail assembly. On the rear face are welded the hinge assemblies, on 20-foot centers to match the boom ends, and to them are attached pillow blocks to allow the rail to be angled. These blocks swing on 1½-inch shafts which are fixed to the booms.

Movement of the rail in or out at either side independently is possible through use of a sliding hinge at one end, *Fig.* 4. It utilizes a Thompson ball linear motion bushing which permits the hinge assembly to slide on a shaft fixed parallel to the channel rail. Alignment is maintained by two small rollers bearing against the lower edge of the rail.

Vertical travel of the booms is accomplished through chain and sprocket drives, powered by a ½-hp motor through a gear reducer. Maximum vertical travel of about 8 feet is possible at a speed of about 25 inches per minute. With both shafts coupled to a common gearbox, each saddle will travel up or down uniformly, thus maintaining a horizontal rail at all times.

Side booms have independent drivers for lateral movement, using ¼-hp motors and belt-driven gear reduction systems to give lateral boom speed of about 60 inches per minute.

One unusual application of this machine involved the fabrication of box-sections from 10-inch channel, with welds along the mating flanges. Before development of the manipulator, shop costs were $8000 on the complete welding job. In the revised setup, a fixture was designed to clamp the two channels together, eliminating the need for tack welding.

In one beam, at 24-inch intervals, are twelve air cylinders, as shown in *Fig.* 1. They are connected to a common manifold to give a maximum combined squeezing force of 36,000 pounds.

Channels to be welded are dropped into the fixture against stops. Air pressure forces them together. A continuous bead can be laid the entire length of the joint in one setting. Then the fixture is rotated 180 deg and the opposite side is welded similarly. A cost analysis on the job shows a saving of about $550 over the former $8000.

Relative to the machine, total cost, including materials, parts, motors, machine work, outside subcontracting and welding generator, was about $4600.

Correction: In Max Kronenberg's article "Effects of Chip Compression on Cutting Forces" published in the April issue, there is an error in *Fig.* 6, page 93. The upper curve for Ernst and Marchant is based on $C = 90$ deg; the lower curve for Ernst and Marchant is based on $C = 75$ deg.

Vacuum Processing

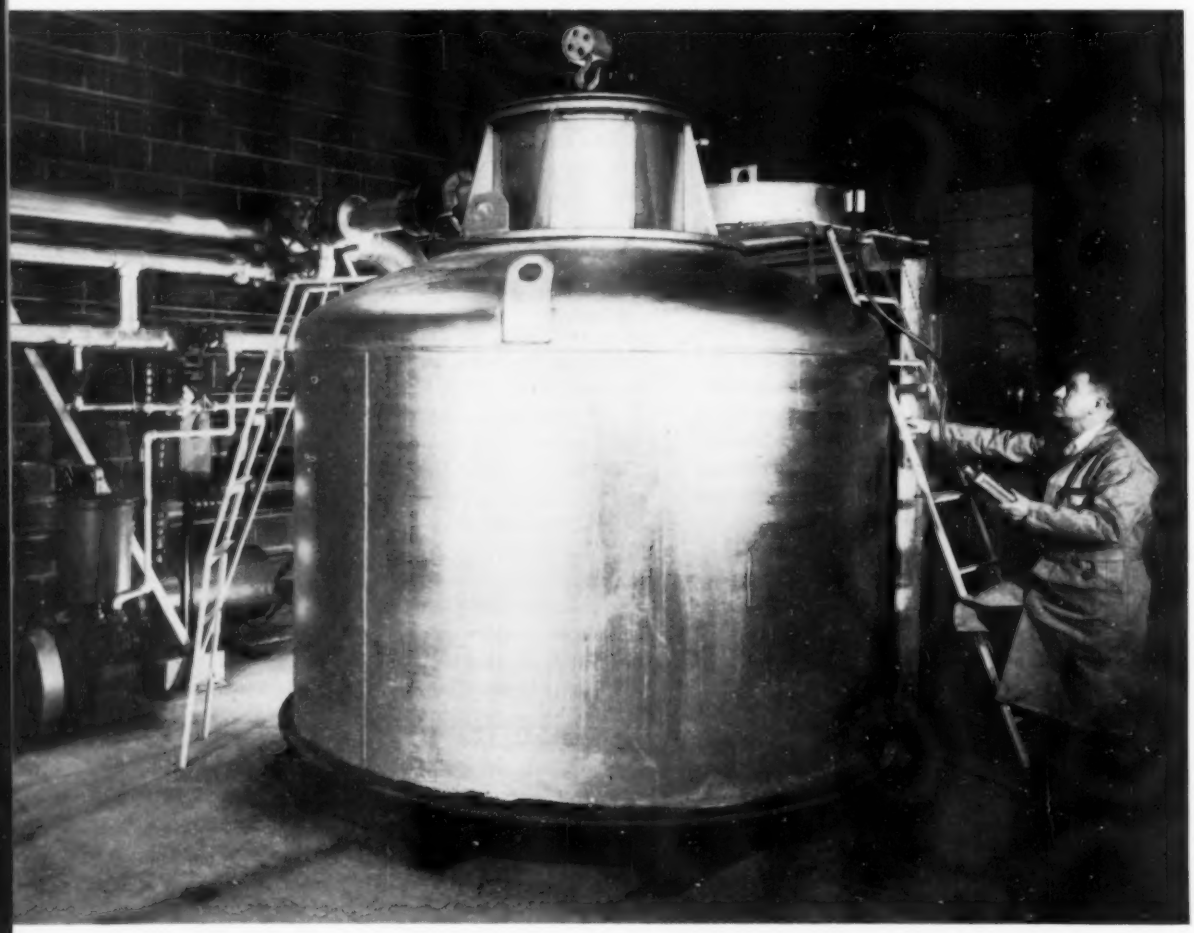
improves material and product quality

In conventional brazing and heat treating, protective atmospheres are frequently used to prevent oxidation and to keep parts and assemblies clean. Bottled gases, cracked gases and burned gases are substituted for the air in the work chambers of furnaces to minimize the formation of oxide films.

Unfortunately many of the new high performance materials contain alloying elements that react with the substituted atmosphere. The reactions result in low physical properties, films that prevent wetting and flow of brazing alloys, and other deleterious effects. The obvious solution is to eliminate all the reacting gases by surrounding the parts and assemblies with a vacuum in a special furnace.

Vacuum furnaces, *Fig.* 1, may be gas or electric heated. Three requirements of vacuum heat treating and brazing furnaces are a heating source, a sealed chamber and a pumping system. In batch

Fig. 1. Sealed retort being withdrawn from furnace. Capacity of this retort is 1000 lb.



By Robert F. Gunow
President
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furnaces, *Fig.* 2, parts to be processed are positioned in the chamber. The chamber is then evacuated and the heat applied.

The degree of vacuum required depends on the nature of the work. Plain carbon and low alloy steel may be bright processed at pressures of fifteen to twenty-five microns, stainless steels in the range of five to twenty microns, while titanium and certain high-temperature alloys require pressures of one micron or less. To achieve these low pressures it is customary practice to combine in the pumping system mechanical pumps with oil diffusion or injector pumps. Since ordinary manometers are not sensitive enough to obtain these low readings, special thermocouple and ionization gages are used.

Titanium, zirconium, aluminum and beryllium are chemically active at elevated temperatures and readily form gas metal compounds. The adverse results of the reactions may affect only the surface or, as in the absorption of hydrogen in titanium, may also affect the core. As little as 150 parts per million of hydrogen in titanium and titanium alloys is considered excessive.

Titanium and zirconium sheet strips and forged products are annealed in vacuum to prevent oxidation and to retain metallic luster. Since heating in a vacuum degases these materials, the annealing treatment is often combined with the degassing treatment in the same operation. Other commercial applications involve stress relieving of welded structures, age hardening of thin metallic diaphrams, annealing of high permeability materials for electrical applications and degassing of instrument parts.

Vacuum brazing is similar to conventional atmosphere brazing. Capillary flow, positioning of the brazing alloy and heating cycles are much the same as found in atmosphere furnace brazing. However, the advantages of the vacuum process are increased strength of brazed joints, increased latitude in choice of materials, increased wetting and flow of brazing alloy and cleaner assemblies.

Approximately fifty percent increase in shear strength of vacuum brazed joints over salt-brazed and hydrogen brazed joints has been reported. Since flux is not required in vacuum operations there is no danger of flux or gas entrapments that would severely reduce the over-all strength of the joint. Further, the elimination of interstitial gas pickup promotes greater ductility in the base materials as well as in the brazed joint.

Titanium and aluminum contents in base materials in excess of 1½ percent inhibit wetting and flow of brazing alloys. Commercial alloys containing these additions, such as Inconel-X, R-235 and A-286, cannot be brazed in ordinary furnace atmospheres without special procedures utilizing plating or fluxes. Fortunately most of these "hard to braze alloys" respond favorably to vacuum

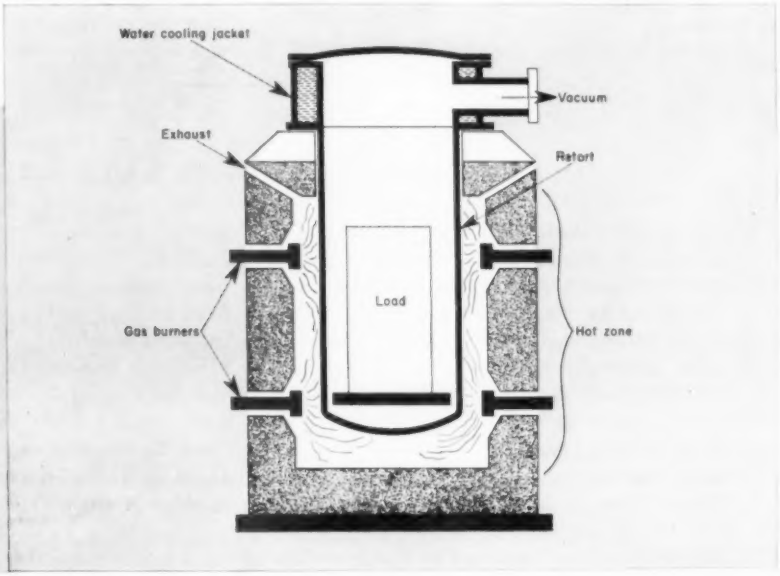

Fig. 2. Typical gas-fired vacuum furnace. Retort is normally removed from furnace for the cooling cycle.

Fig. 3. Cross section of stainless-steel corrugated assembly. Restricted flow of protective atmosphere can cause difficulties when brazing this type of part.

processing. Inconel-X cone sections 25 inches in diameter and 30 inches high have been brazed in vacuum with excellent results.

Structures containing blind holes adjacent to joints, or other areas where free flow of atmosphere gas is impossible, are difficult to braze even when made from materials ordinarily considered to have good brazing characteristics. Where free flow of atmosphere is prevented the locked-in gases form oxide films which in turn inhibit wetting and flow of the brazing alloy. Fine corrugated structures, *Fig.* 3, and honeycomb sandwich assemblies are examples of parts where restricted gas circulation causes problems. These problems are avoided by brazing in vacuum.

A number of brazing alloys can be used in the vacuum process. Copper, silver, nickel and gold base alloys are used extensively. Nickel base alloys are particularly suitable because they have high strengths at elevated temperatures as well as excellent corrosion resistance.

In general, alloys containing high vapor pressure constituents are avoided. Low-temperature silver alloys, for example, are not employed in vacuum brazing because the cadmium and zinc volatilize during processing.

A new application of vacuum techniques is the infiltration of powder-metal composites with brazing materials. Parts made in this way have surprisingly good ductility and strength. As vacuum processing becomes better known, many other new applications will doubtless be found.

Machinable Carbide Cuts Costs

A NEW carbide material, called Ferro-Tic, is produced by powder metallurgy techniques and has a composite structure which can be annealed and quench hardened by conventional heat-treating procedures. In the annealed state it is readily machinable; such metal removing operations as turning, milling, drilling and sawing are easily performed. Thus, components with highly complex forms or a multiplicity of holes, thin walls or drastic changes in cross-section, can be cut from standard blanks, permitting the user to fit the carbide to his needs.

The hardening operation, following generally established practices for tool steels, involves oil quenching from a temperature of 1700 F. Once hardened, the material appears to assume unusual wear resistance characteristics derived partially from its hard carbide phase and partially from a hardened matrix.

Example of Ferro-Tic in use is a die for progressive blanking of 0.008-inch cadmium-plated beryllium copper. A die and punch set comprised of Ferro-Tic inserted sections is reported to produce 13 times as many parts between sharpenings as previous sections. The intricate components were machined from solid blanks and completely processed by the user in his own toolroom.

applications of NUMERICAL CONTROL

Tool engineers interested in numerical control as a possible solution to production problems have numerous questions regarding specific applications and advantages of this new technique. The author answers many of these questions and suggests methods to make numerical control even more attractive.

Abstracted from Paper 91, "Potentials of Numerical Control in Manufacturing Operations," to be presented at the 26th ASTE Annual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

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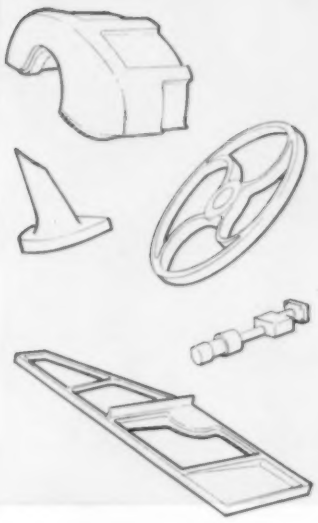
NUMERICAL CONTROL is advantageous in job-shop production operations where flexible, general-purpose machines are required, as well as in toolmaking and engineering model shop operations, where high precision and minimum lead time are important considerations.

Applications of numerical control are of two basic types: path control, required chiefly in profile and contour milling or turning; and position control, required in jig boring, punching, drilling, spot welding and similar operations.

Most of the tape-controlled machine tools now in operation are being used to machine complex airframe parts such as wing skins, fittings, structural



Advantages of Tape-Controlled Drilling

Basis for Comparison	Conventional Method Drill Plate	Drill Jig*	Tape Control
Initial Cost (dollars)	200	450	5-10
Cost of Rework, Maintenance and Storage (dollars)	100	250	10
Average Tool Cost Per Part—20 Pieces (dollars)	15	35	0.75-1.00
Average Tool Cost Per Part—1000 Pieces (dollars)	0.30	0.70	0.02
Average Run Cost Per Part (dollars)	0.10-0.50	0.20-0.75	Comparable
Accuracy of Hole Location (inch)	+0.002	+0.002	±0.0001-0.002
Tool Fabrication or Rework Time (days)	10-40	10-50	1

*Box—200 cu. in.

forgings, and other production parts. In addition to these production machines, several installations have been made for the purpose of producing tools and prototype equipment. One such machine, installed at North American Aviation, produces templates, cams and other profiled tools used in airframe manufacturing. This system performs 360-deg profile milling, scribing and drilling.

A control system developed by Autonetics Div. of North American Aviation provides path or positioning control from information supplied on a punched tape. The system employs transistors to eliminate disadvantages of vacuum tubes and has plug-in circuit board construction for easy maintenance.

Number data from the control tape is converted into a series of command pulses. Each pulse calls for a machine movement of 0.0002 inch. Linear optical feedback gages placed along each axis of motion translate movements of the machine into similar pulses. These are compared with the command pulses to insure that tape orders are carried out.

Machine control tapes for contouring control are produced with the aid of a general-purpose digital computer. Tapes for control of positioning only,

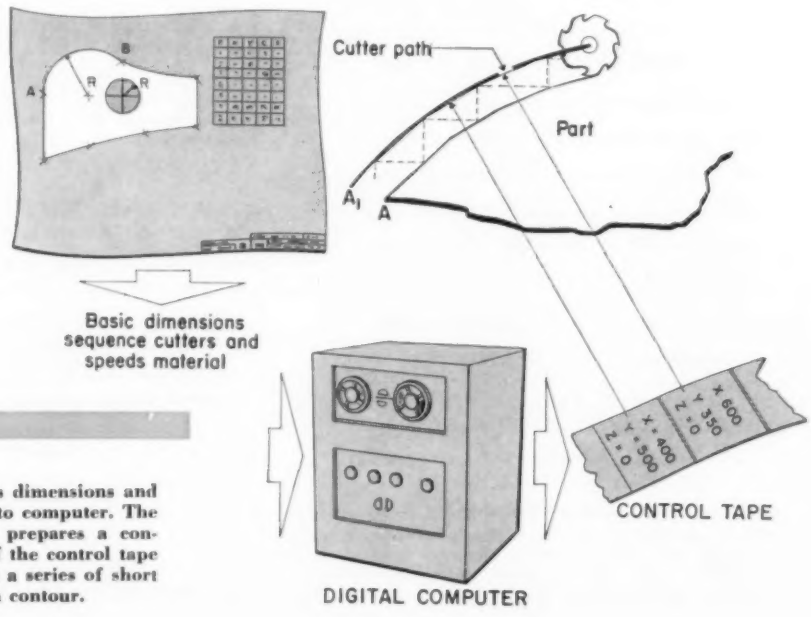


Fig. 1. Planner supplies dimensions and machining information to computer. The computer automatically prepares a control tape. Commands of the control tape direct the cutter path in a series of short straight motions to form contour.

for such operations as hole drilling, do not require a computer for preparation. They are punched on a keyboard with information taken directly from drawings.

Path Control Programs: For path control applications the engineer or planner takes basic dimensions from the engineering drawing, adding cutter and machining speed information and sequence of operations. This information is entered into a computer by means of punched cards or tape. The computer automatically produces a tape which contains all data necessary for machining the part.

The computer defines the path of the cutter as a series of short straight line segments, *Fig.* 1, and determines cutter accelerations and feeds. The part dimensions set down by the planner are related to a selected datum point. The series of arcs and tangent lines on the part profile, *Fig.* 2, need be defined only by giving radii and center coordinates of each arc. The computer calculates the cutter path required to generate the profile. Various other computer routines, *Fig.* 3, are used for defining conics and faired points.

Position Control: For drilling and related operations, which otherwise require the use of jigs, the chief advantages of tape control are reduction of tooling investment and lead time and increased design flexibility. The cost of building, maintaining, storing and reworking jigs is frequently a major portion of the total cost of each part produced by usual methods. Tape control virtually eliminates this cost and may improve both machine productivity and quality of output. An example is combination of positioning and process control in spot welding, which offers greatly increased productivity with improved quality.

Savings in Machining Costs: North American Aviation produces single part profiled tools by tape-controlled machining. Cost savings over conventional methods are $100 to $200 per hour of machining time. In the case of a pair of profile mill fixtures, for example, total manufacturing costs were $200 when the fixtures were produced by tape control, as compared to $1308 for fixtures produced by conventional methods. The time required for production by numerical control was two days. Over four weeks was required for conventional methods. Further, closer tolerances were held in the tape-controlled operations.

Similar savings are obtained when drilling complex hole patterns, which would otherwise be jig-bored, as shown in the accompanying table. As improvements are made in tape planning and computation methods, the advantages of tape control will extend to even the least expensive profiled tools.

Other Advantages: Along with effecting substantial cost savings by improving machine cycle efficiency and eliminating costly tooling, numerical control minimizes human error and reduces operator fatigue.

Close tolerances can be achieved without dependence on highly skilled toolmakers. With care, parts up to 36 inches long can be produced to tolerances closer than 0.005 inch. Normally, tolerances of hole patterns and profiles are held to ±0.001 or 0.002 inch.

Parts or tools can be made within a few hours after receipt of the design drawing. Design changes are affected with comparable speed, virtually eliminating long lead times.

Increasing Efficiency: Experience in tape making has shown a number of areas for future

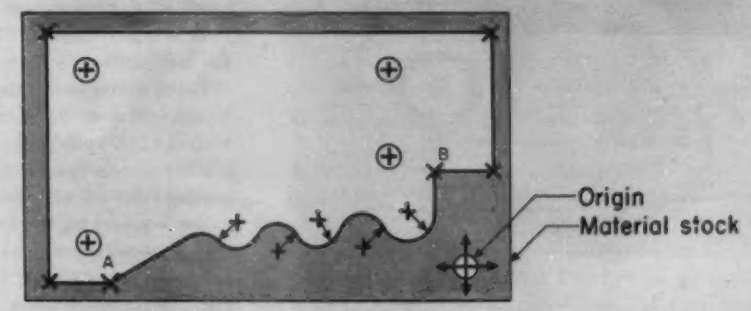


Fig. 2. Arcs and tangent lines are defined by radii and coordinates. Computer automatically calculates cutter path.

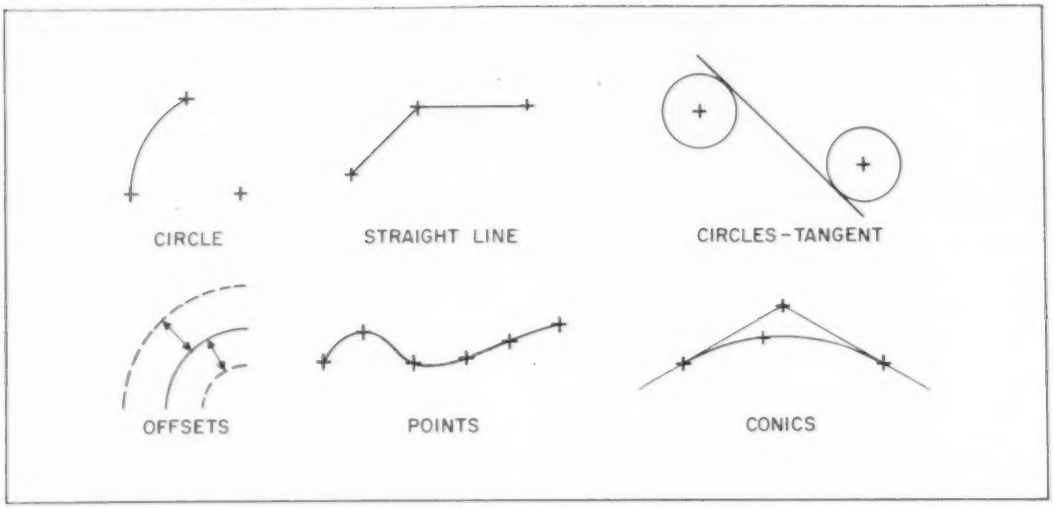


Fig. 3. Various computer routines are used for different profile sections.

improvement of numerical control techniques. Proper dimensioning with numerical control in mind eliminates the need to redimension drawings during planning. This nonproductive work may consume 70 to 80 percent of the planner's time.

Planners must know or develop correct machining data such as cutter types, feeds and speeds. Otherwise a major benefit of tape control is lost. In addition, since minimizing setups is a major objective of tape control, planners must be ingenious in developing general-purpose fixtures and workholders.

Improved tape programs will further reduce the planner's work and thus reduce cost as well as error. For example, the computer is capable of determining proper cutters and speeds and operational sequences. Die sinking and other complex machining operations can be profitably done by tape control only if such automatic routines are available.

Potential Applications: Areas of potential advantage are identified by the same factors as indicated in present work. Defense industries appear to be developing an increasing number of items whose design is achieved mathematically; for example, airfoils, blades, propellers, impellers and radomes. These all suggest logical uses of numerical control. Special requirements such as the machining of toxic substances and handling radioactive materials offer new potentials.

Data Processing Speeds Customer Service

An electronic data processing system has speeded up product delivery to customers of The Carborundum Co. by as much as three weeks. The integrated order processing procedure links the company's domestic sales offices, warehouses and plant locations directly by teletype with a computer center at the firm's headquarters.

Three of the ten operating divisions are operating under the Remington-Rand system with six of the 12 sales offices and warehouses which serve the three divisions across the country currently participating. Carborundum's inventory control lists more than 47,000 different items. Large volumes of these products are stocked at sales offices and warehouses.

Approximately 1000 orders are received daily by the sales offices. Under the integrated processing procedure, an order received at a sales office is processed on a punched-tape typewriter, which produces both a typed document and a paper tape record of the information it contains.

From a magnetic tape, to which the information is converted at the Control Center, the computer searches and updates the inventory. It then produces a teletype message for transmittal back to the originating sales offices indicating action to be taken.

While searching the inventory, the computer automatically orders a product to be shipped out of a neighboring warehouse or plant if it is not available at the originating office. If the item is in the "custom" category, it prints out a production order to the factory. The entire process is completed in a matter of minutes.

making plastic dies

with steel-epoxy compounds

IMPROVEMENTS IN MATERIALS have led to many successful applications of plastic dies. Some of these new tooling materials incorporate metal fillers to give longer die life, making possible production runs of thousand of pieces. One such material, developed by Minnesota Mining & Mfg. Co., is a mixture of epoxy resins and steel. Since the compound is 90 percent steel, it combines the production advantages of metal dies with the ease of fabrication that is characteristic of plastic dies.

The compound has a compression strength of 22-26,000 psi, impact strength of 0.4 ft-lb per inch of notch and is sufficiently abrasion-resistant to stand up well under press forming operations. Owing to its high steel content, the compound conducts heat readily, preventing excessive heating.

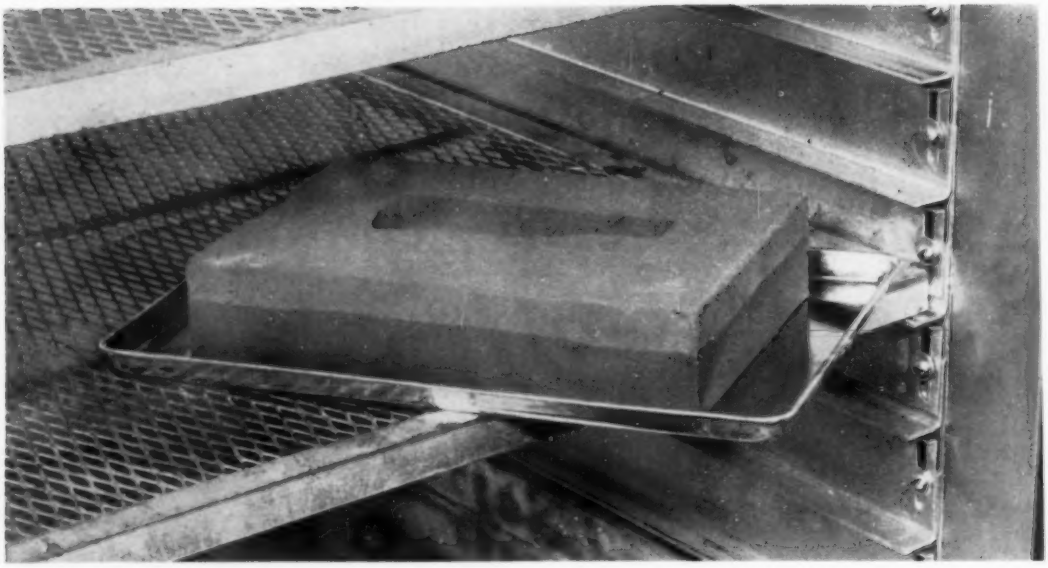
Tools made of the material have been successfully employed for forming small quantities of parts with complex shapes or long production runs of simple parts. Recently, a large custom fabricator of metal parts used the compound to make a punch and die for a cable splice. The splice was about 6 inches long and 2 inches wide, and included some circular and double draws up to 7/8 inch deep. Some 2000 parts were formed from 0.036-inch thick cold-rolled steel.

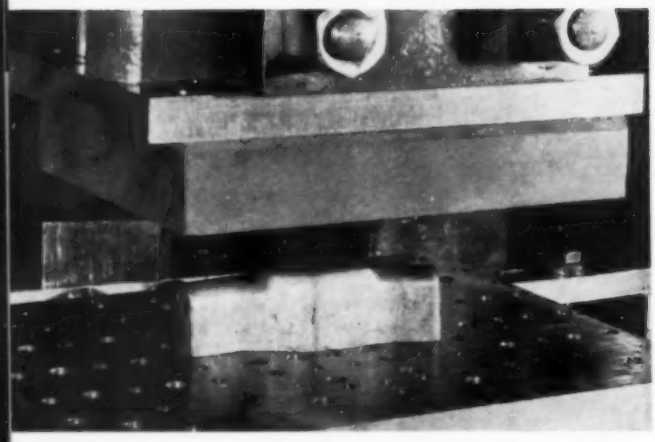
Starting with finished wood and plaster patterns, the punch and die were cast, machined, and drilled and tapped for press mounting in only 4.8 man-hours, over the course of three eight-hour working days. Delivery time for a comparable metal die was estimated as three weeks, exclusive of the time required for machining the mounting holes.

The punch and die were bolted onto a 45-ton Bliss press in the same manner as steel tools, using no frame or box, and were operated at the rate of 300 pieces per hour for four hours. According to the fabricator, this production rate could have been

Parts of 0.036-inch-thick cold-rolled steel are formed at a rate of 300 pieces per hour, using a plastic punch and die.

Die pattern being removed from preform. The preform has sufficient green strength to permit handling without damage.





Above—After one-half hour in oven at 300-325 F, preform is more than half impregnated with resin. The resin spreads by capillary action.

Plastic punch and die mounted in press. They showed virtually no wear after 1200 parts had been run under production conditions.

increased to 600 pieces per hour, but was reduced so that one operator could handle blank greasing as well as the press operation. Tool wear after the run was negligible and considerable addition production is expected. The parts met the same quality standards as parts produced on conventional steel dies.

Making the plastic dies is relatively simple. The compound has two components: a treated metal powder that can be formed into shapes having good dimensional stability and a thermosetting epoxy liquid resin used to impregnate the molded shapes to make them permanent and durable.

Plaster, metal or wood patterns can be used. Prior to molding, the patterns are polished with a hard wax of the carnuba type. Wood and plaster patterns are sealed with two coats of lacquer before waxing.

In molding, the treated metal powder is packed into the pattern with a metal dowel or block to obtain adequate density. The excess powder is struck off, a metal supporting plate is placed on top of the pattern, the assembly is turned over, and the pattern is removed.

The preform is dried on the supporting plate in an oven at 300-325 F. One hour of drying time is allowed for each one-half inch of material at the thinnest cross section.

After drying, the preform is placed, with its molded side up, in a flat pan or tray containing the liquid resin. The pan is put into an oven for curing at 300-325 F. At this temperature, the proper amount of resin will completely impregnate the preform by capillary action in one to two hours. The weight of resin required is approximately one-tenth the weight of the preform. The molder determines the amount without weighing, simply adding resin from time to time, if necessary, to carry impregnation to the top of the preform during curing. The preform cures to a hard, dense mass in 12 to 16 hours.

The cured tool can be drilled, tapped, or ground for flat-level mounting with standard machining processes. Due to the steel content of the compound, magnetic chucks can be used to hold cured tools during machining. Wet sanding or buffing will give a superior finish.

machining titanium

By G. William Bauer
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IN ORDER TO EFFICIENTLY MACHINE titanium and its alloys, it is essential to understand their machinability characteristics. The hardness of titanium may range from 50 Bhn for very pure material to 500 Bhn for age-hardened alloys. Titanium has a very low thermal conductivity which creates a tendency for the tool to weld to the chip. In addition, the chemical activity of titanium at high cutting temperatures makes seizing a problem. Titanium's modulus of elasticity is about one-half that of steel; consequently, more rigid backing of the workpiece may be required, particularly for long, unsupported lengths.

In general, the machining characteristics of titanium are similar to those of austenitic stainless steels. Even the hardest alloys are easier to machine than most special heat-resistant steels. Extensive production experience has led to a better understanding of the fundamental requirements for machining titanium and to much more efficient machining. The alloys used five years ago were extremely difficult to machine, due to their high carbon content, but titanium alloys today generally contain less than 0.1 percent carbon and have much better machinability.

Table 1—Speeds and Feeds for Turning Titanium

Workpiece Material	Tool Material	Cutting Speed (fpm)	Feed (ipr)
Commercially pure titanium (MST-40, MST-55, MST-70)	Carbide	300-320	0.008-0.015
	Cast alloy	170-200	0.005-0.010
	HSS	150-170	0.004-0.007
Titanium alloys (MST 6A1-4V)	Carbide	120-160	0.008-0.015
	Cast alloy	50- 80	0.005-0.010
MST 3A1-5 Cr, etc.)	HSS	30- 60	0.004-0.007

Turning: Basic rules of thumb for turning titanium alloys are as follows: (1) Use rigid fixtures, tools and machines; (2) keep tools sharp; (3) lubricate with water-base cutting fluids. Titanium may be turned with high-speed steel, cast alloy or carbide tools. Recent work with ceramic tools, particularly those containing aluminum oxide, indicate that surface speeds up to 600 fpm may be obtained. This is almost double the cutting speed with carbide tools. With a sharp tool, the coefficient of friction is quite low and, consequently, a machined surface finish of 20-30 microinches may easily be obtained. When a wear land occurs on the tool, the cutting heat increases so much that smearing takes place. For the same reason, it is recommended that live centers be used to prevent galling or seizing.

Recommended speeds and feeds for turning of titanium and its alloys are shown in TABLE 1. Cutting speeds for alloys are one half those used for

Abstracted from paper 118, to be presented at the 26th ASTE Annual Meeting. Copies of the complete paper will be available from Society Headquarters.

commercially pure titanium. Heavy forging scale should be completely undercut at speeds one-fourth those of normal. Suggested tool angles for turning are shown in TABLE 2. To maintain as low a cutting temperature as possible, water-base cutting fluids such as soluble oils or chemical type fluids are recommended; however, lubrication is less important than keeping the work surface cool.

Milling: Recommendations for milling of titanium are: (1) Use rigid machine, workpiece, and tool setups; (2) employ a climb milling cut where possible; (3) use water-base cutting fluids to minimize tooth wear. Milling is more difficult than turning. Each tooth is cutting only a part of the time. Because of the high chemical activity of titanium at the cutting temperatures involved, chips may become welded to the cutter teeth. These chips must be knocked off when the next cutting operation begins. Consequently, cutter teeth are subjected to continual wear and shock, and breakage

Table 2—Tool Angles for Turning Titanium

Tool Material	Back Rake (deg)	Side Rake (deg)	SCEA (deg)	ECEA (deg)	Relief (deg)	Nose Radius (inch)
Carbide	0	6	6	6	6	0.040
Cast alloy	5	5-15	5-15	5	5	0.005-0.010
HS Steel	5 pos	5-15	5-15	5	5	0.010

Table 3—Tool Angles for Face Milling Titanium

Tool Material	Axial Rake (deg)	Radial Rake (deg)	Corner (deg)	ECEA (deg)	Relief (deg)
Carbide	0	10 neg.	60	6	12
Cast Alloy	0	0	30	6	12

is a serious problem. Breakage may be prevented to some extent by proper feeds and speeds and by using rigid setups.

The preferred practice is to use climb milling, since the cutter is in contact with only a small portion of the chip when leaving the work. When climb milling, caution is advisable. Any looseness in the machine setup may result in the workpiece being pulled into the cutter, possibly damaging both the cutter and the workpiece.

Titanium can be milled with carbide, cast alloy, or high-speed steel tools. The recommended speeds and feeds are approximately one-half those used in turning. The tool cutting edge usually fails because of chipping. Cast alloy tools, being less brittle than carbides, may be the most economical choice. The 20 to 30 percent higher cutting speeds allowable with carbide milling cutters may be more than offset by increased tool grinding costs. It is better to try all three types of tools for a given milling operation to determine the best tool. As in turning, water-base cutting fluids are satisfactory.

Recommended tool angles for face milling are shown in TABLE 3. The major difference between cutters used for steel is the appreciably larger relief angle. A relief angle of 11-13 deg is recommended since higher angles cause chipping and lower angles cause smearing. Fast spiral cutters are most efficient.

Drilling and Tapping: In drilling, allowance has to be made for the same factors which make milling and turning difficult; i.e. the tendency for the chip to weld to the tool, thus increasing the cutting temperature and causing galling, seizing, or tool failure. Sharp drills and rigid fixtures should be used. Slow speeds and relatively heavy feeds give best drilling results. Some other general recommendations are:

1. Use high-speed steel drills. Drills should be as short as possible to prevent runout and inefficient cutting.
2. Use cutting speeds of 50-60 fpm for commercially pure titanium, 30-50 fpm for alloys.
3. Optimum feeds are about 0.007 ipr for ¼—½-diam drills, 0.003 ipr for smaller drills.
4. The best drill angles are a point angle of 90-140 deg (using larger angles for smaller drills), a helix angle of 28 to 35 deg and a lip relief of about 10 deg.
5. Active cutting fluids, such as sulfurized or chlorinated oils, are best for drilling small holes. Larger holes should be copiously lubricated with a water-soluble oil.

Further improvements in drill life may be obtained by using a double-point angle such as 140 deg near the point and 90 deg at the corner. Newer techniques like spiral-point drill grinding offer additional improvements.

Tapping of titanium may be made much easier by proper drilling. A hole which is not clean cut may be surface hardened to such an extent that tapping would be extremely difficult. One of the serious problems in tapping is proper chip removal. Use of active sulfurized-chlorinated oil facilitates chip removal. In tapping through holes, a gun type tap is recommended so that the chips are pushed ahead of the tap.

Because of the difficulty of proper chip removal, it is best not to design blind holes that require tapping. The most successful tapping has been accomplished with 55 to 65 percent threads and by keeping the number of threads to a minimum. Gun or spiral-point high-speed steel taps are recommended for titanium. Two-fluted taps are better for sizes $\frac{1}{4}$"-20 and under and three-fluted taps for sizes greater than $\frac{1}{4}$"-20. Commercially pure titanium should be tapped at 40 to 50 fpm; speeds of 20-30 fpm are recommended for alloys. Tapping of alloys having a hardness greater than 37 R_C is extremely difficult.

Grinding: In grinding titanium, best results are obtained by using considerably lower speeds than for steel and by proper lubrication. Dry grinding is definitely not recommended. Nitrite-amine rust inhibitors and sulfurized-chlorinated oils give the most satisfactory lubrication. A grinding speed of about 1500 fpm is recommended. Use of 0.001-inch maximum downfeeds will prevent attrition caused by wheel materials chemically combining with the titanium.

When equipment capable of operating at low grinding speeds is not available, silicon-carbide vitrified wheels can be used; however, aluminum oxide vitrified wheels, used at low speeds, give best results.

With proper techniques, the grinding of titanium is similar to that of high-speed steels. Special care must be used to avoid overheating the surface as cracking may result. Mechanical holding fixtures are necessary, since titanium is nonmagnetic.

Sawing and Cutting: Wet abrasive cutting is recommended for titanium. Bars of 3-inch and smaller diameters are cut with an oscillating wheel. Larger bars are rotated during cutting. This keeps the area of contact between wheel and metal as small as possible. Use of a water-soluble cutting oil will minimize chemical reactions between titanium and the abrasive wheel.

Silicon carbide is the only satisfactory wheel material for cutting titanium. Approximately 3 square inches per minute may be cut using a wheel speed of about 7000 fpm.

When hacksawing alloys, the best practice is to use fairly coarse-pitched molybdenum high-speed steel blades under high tension. Slow speeds (50-60 fpm) and a continual positive pressure are necessary. If the blade merely rides on the workpiece, it may harden the titanium to such an extent that further cutting is impossible. Lubrication with a water-soluble cutting oil is desirable.

Requirements for efficient bandsawing of titanium are about the same as those for hacksawing; however, bandsawing is a more efficient operation. It has been found that standard high-speed steel blades can be made to last 10 times longer by grinding the blades to strength the teeth and eliminate the negative cutting angle. Lubrication is not necessary for bandsawing titanium alloys. Commercially pure titanium is lubricated to prevent chip loading. Rigid machine setups are important for proper bandsawing.

Other machining operations such as shaping, broaching and reaming have not been described here but the fundamental requirements are the same as for other titanium machining operations. These requirements can be summarized as:

1. Sharp Tools: High-speed steel or carbide tools are generally required. It is important to keep them sharp because of the tendency of titanium to weld to the tool, with resultant smearing or galling.
2. Rigid Machines: Although titanium does not require as much power to machine as stainless steel, more rigid machines and fixtures are desirable for most efficient machining.
3. Slow Speeds—Heavy Feeds: These rules of thumb apply to all phases of machining titanium. It is particularly important never to allow the tool to ride on the metal.
4. Lubrication: Water soluble cutting oils are usually sufficient to keep friction (and galling) at a minimum. However, drilling, tapping, and grinding require special lubricants for most efficient machining.

When these requirements are taken into consideration, satisfactory results will be obtained.

selection of
Barrel Finishing Compounds

MOST PRECISION barrel finishing operations are performed "wet"; that is, parts and media are covered by water during tumbling. The water acts as a lubricant and carries abraded material away from the surfaces of the workpieces. Barrel finishing (tumbling) compounds, added to the water in the ratio of a few ounces per gallon of water, can control the cutting action and can also improve the finish of the workpiece. Some of the characteristics required of a compound are:

- WATER CONDITIONING: In hard water, insoluble soaps are formed that coat workpieces, media ("chips") and barrel linings. Media lose much of their cutting effectiveness when loaded with these insoluble deposits. Accordingly, compounds should contain suitable water conditioners.
- LUBRICATION: Compounds increase the lubricating effect of water. The lubricating action of a compound can be controlled by diluting it with water to the proportions that give best results for the application. High lubrication reduces the cutting rate; low lubrication increases the cutting rate. High lubrication improves the color and luster of workpieces.
- SUDSING: This characteristic provides carrying power to keep ground-off particles in suspension. Compounds that give minute suds particles and maintain a uniform film between media and parts give best results. Suds should be tough, thick and long lasting and be capable of converting the entire liquid phase of the work zone into a sudsy mass.
- SUSPENSION: It is important that worn-off particles of media and workpieces be dispersed evenly to prevent an uneven concentration of the particles. This dispersion is facilitated by appropriate agents in finishing compounds.
- CLEANING: While it is sound practice to always start with clean parts and media, a tumbling compound should be a good cleaner.
- RINSING: Tumbling compounds should be free rinsing so that the parts and media can be easily and quickly cleaned after the barrel finishing operation.

In addition to these general characteristics, finishing compounds should be selected on the basis of their suitability for specific applications. There are three basic types of compounds: neutral, alkaline and acid. Typical applications for each type of compound are shown in the accompanying table.

Acid compounds develop gases with many metals and should never be used in a closed barrel without adequate vent control. They must be neutralized and flushed away after use.

Abrasive grit is often added to finishing compounds to accelerate cutting action. The proper grit size and amount of grit added to the compound can best be determined by experiment. Larger grit gives fastest cutting action; smaller grit gives a slower cutting action but results in smoother finishes.

Selection of Tumbling Compounds

Workpiece Material	Type of Work	Type of Compound
Low carbon steel High carbon steel Stainless steel	Light rust or scale removal	Neutral or alkaline
Low carbon steel High carbon steel Stainless steel	Heavy rust or scale removal	Acid
Low carbon steel High carbon steel Stainless steel	Light-to-medium stock removal; deburring; generating radii	Neutral or alkaline
Low carbon steel High carbon steel Stainless steel	Heavy stock removal	Alkaline
Low carbon steel High carbon steel Stainless steel	Lustering, coloring	Neutral
Cast iron	All types of work	Alkaline
Aluminum, copper, zinc, brass, gold, silver, other nonferrous metals	All types of work, especially lustering and coloring	Neutral
Aluminum (alternate)	Deburring, generating radii	Alkaline
All metals	Microfinishing	Neutral
Plastics and rubbers	Deburring and finishing	Neutral

Data courtesy Finger Lakes Chemical Co., Etna, N.Y.

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NEWS

ASTE's stake in the future

. . . scholarships reward students' diligence

EARNEST, serious-minded, eager, intense . . . These words characterize the twenty-two students chosen to receive ASTE's 1958 International Scholarships. Selection of the ten college and twelve technical institute students who will receive $12,000 worth of educational opportunity in the tool engineering sciences was based on scholastic records, personal recommendations of faculty members, financial need, and the sincerity and eagerness to further their education, as expressed in their letters of application.

College-level awardees who will receive $700 apiece for their conscientious pursuance of tool engineering know-how are:

Dietrich W. Brunner	MIT
Jesse L. Crews	California State Polytech
Frank D. Galbraith	Ohio State University
James M. Hardy	University of Michigan
Juergen Mattke	Rochester Tech
Darrell Palmer	Utah State University
Joseph R. Strode	University of Illinois
Walter W. Thrush	Pennsylvania State College
John E. Vollmer	Queens University (Ontario)
James P. Young	State University of Iowa

At the two-year technical institute and junior college level, the following men were picked to receive awards in the amount of $400 each:

Jack A. Banning	Gaston Technical Institute
George B. Cowan	Indianapolis Center, Purdue
Peter Frigano	Long Island Ag & Tech
Ronald D. Graves	Canton Ag & Tech
James A. Hermanson, Jr.	Erie County Tech
Arthur J. Hope	Ryerson Institute (Ontario)
Zane David Kuder	McKeesport Center, Penn State
Robert W. Menzies	San Francisco City College
Roland V. Mercier	Franklin Tech
Paul E. Murphy	Wentworth Institute
Angelo Scarafino	Mohawk Valley Tech
Ronald Waite	Long Beach City College

The winners range in age from 19 to 32, but the average age is 25. More than half are married, with family responsibilities in addition to the financial burden that going to school brings. Working twenty-five hours a week is more common than not among the twenty-two chosen.

Typical of the serious outlook and resolute direction of energies found in the majority of applicants, Peter Frigano, who has maintained an "A" average for his first two quarters at Long Island Ag & Tech, writes:

"This I attribute to the maturity I have acquired through the years (Mr. Frigano is 26), and the full knowledge of the importance of this training to achieve my goal in the tool design field. Furthermore, I have sacrificed a position which offered security and good wages because I now realize *the importance of education.*

While maintaining his high average during his second quarter of schooling, he has been working five hours a night during the week, "studying into the wee hours of the morning, and the entire week end too." He intends to strike out for a B.S. in mechanical engineering after his second year at the Long Island school.

As one of his professors says of him, "It takes 'guts' to quit a good paying job at age 25 and start to train again in a college."

For him, and the others like him, the ASTE scholarship will bring a boost to the morale, the reassurance that studiousness does "pay off," and a relaxing of the physical and mental strain that must accompany such diligent application performed under a cloud of financial worries. And for the rest of us . . . it may bring another skilled scientist or engineer into a country with a crying need for such skill.

1958 Honor Awards Announced

HONOR AND RECOGNITION in the form of six gold medallions will come to as many men, conspicuous by their outstanding contributions to the progressive science of the tool engineer, and to his sponsoring society, ASTE. Plaques bearing the medals, and individualized citations, will be presented by Harold E. Collins, retiring president of the Society, at the Honor Awards banquet held in Philadelphia May 5, during ASTE's 1958 Convention.

Recipients of the medals, and the endeavors for which they are thus honored, are:

Milton C. Shaw, awarded the ASTE Gold Medal, for outstanding service through published literature, technical writings, or papers dealing with tool engineering.

Max Kronenberg, awarded the ASTE Research Medal, for significant published research, leading to a better understanding of materials, facilities, principles, and operations, and their application to better manufacturing.

Jesse Daugherty, awarded the ASTE Engineering Citation, for unusual skill in the development of tool engineering principles, design or practices.

J. Everett Hollingsworth, presented the ASTE Education Award, for developing dynamic curricula, fostering sound training methods, or inspiring students to enter the profession of tool engineering.

Lester L. Colbert, presented the ASTE Progress Award, for accomplishments in the field of manufacturing processes, methods, or management.

Andrew E. Rylander, presented the Joseph A. Siegel Memorial Award, perpetuated by past presidents in memory of the first ASTE president, for contributions through leadership, voluntary support, or timely acts of benefit to the Society.

Selection of the above men was made by the national honor awards committee, consisting of nine past presidents of the Society. The 1958 committee, chairmanned by A. H. d'Arcambal, consisted of Frank W. Curtis, C. V. Briner, D. D. Burnside, Robert B. Douglas, Irwin F. Holland, Ray H. Morris, A. M. Sargent, and Otto W. Winter.

In addition to the plaques with their medals and name plates, awardees will receive framed engraved citations, texts of which appear on the following pages, along with brief sketches of recipients.

ASTE
Gold Medal

Milton C. Shaw

Head of Metals Processing Div.
M. E. Dept., MIT

Prolific writer of numerous books, treatises, articles, and lectures in the diversified areas of mechanics, physics, chemistry, and metallurgy . . . his writings based upon pure research into metals machinability have been an importantly useful contribution to the Tool Engineering literature.

Dr. Shaw's literary contributions cover a wide range of machining concepts, with particular emphasis on cutting fluid research. As research chemist both for Cincinnati Milling and the NACA, he did research on strength, vibration, lubrication, and high temperature alloys.

After joining the teaching staff at MIT, he began the present metal cutting laboratory which today operates on a $75,000 a year budget. Subsequently connected with the machine tool division and the lubrication laboratory there, Dr. Shaw lectured widely in Europe in 1952 on machine tool problems. He was awarded a Fulbright Grant and a Guggenheim Fellowship in 1956-57 for a teaching program at the Aachen Technische Hochschule in Germany.

ASTE
Research Medal

Max Kronenberg

Consulting Engineer

Internationally recognized authority in metal cutting research and its practical interpretation through a major treatise and through scores of articles published in a number of languages . . . modern manufacturing has also benefited greatly from his studies of machine tool design and performance, and of production processes.

Research engineer with Cincinnati Milling Machine Co. from 1936 to 1950, Dr. Kronenberg has specialized for 30 years in machining research and machine tool development. To his credit are scores of books and articles in French and German, as well as in English. He was consultant to the U.S. secretary of war in 1945, and has had published over 30 reports made to the Government and civil clients on such subjects as machining of artillery shells, deformation and stresses in machine tools, and dimensional analysis of complex gear trains for model tests. He is a consistent contributor to The Tool Engineer. A recent achievement is his revised edition of "Principles of Metal Cutting", originally published in Berlin in 1927.

ASTE
Engineering Citation

Jesse Daugherty

Staff Vice President of Engineering
Giddings and Lewis Machine Tool Co.

A leader of foresight and daring, in the automation of machine tools . . . he has guided the development and refinement of a fundamental tool path programming technique . . . his gifted abilities have contributed greatly to the rapid advancement of numerical control of metal removal processes.

A registered professional engineer in Wisconsin, Mr. Daugherty is widely known in the machine tool industry for his work in numerical controls. He pioneered the automation of one of the first heavy machine tools—the automatic vertical boring mill for overall machining of railroad car wheels. He guided the development of the revolutionary tool path programming technique, now known as Numericord. After serving a machinist apprenticeship from 1919 to 1935, Mr. Daugherty worked in various engineering capacities with the Cincinnati Planer Co. until 1949, when the firm was bought by his present employer. Promotion to a vice presidency followed positions as engineering manager and consultant for Giddings & Lewis.

ASTE Education Award

J. Everett Hollingsworth

Dean of Business and Technology
Long Beach City College

Able educator of shrewd, practical vision in progressive engineering training . . . early organizer for the development of industrial technicians . . . his later planning and determination have greatly facilitated regional approval of college programs leading to degrees in Tool Engineering.

MR. HOLLINGSWORTH has been organizing and promoting technical education since 1932 when he set up classes for some forty students in vocational training at the Long Beach Trade Extension School. Later, as dean of business and technology at Long Beach City College, he designed highly technical programs to meet the needs of industry.

Through his efforts, made jointly with local ASTE members, part-time classes in tool design were developed, leading to a full-time program at the city college. Success of the venture proved to be a stepping stone to higher level training, and the four-year college transfer program was designed. In addition, he helped establish the high school-city college cooperative program.

ASTE Progress Award

Lester L. Colbert

President
Chrysler Corporation

Manufacturing executive of long-range vision and decisive action . . . his organization for the production of bomber engines was a massive contribution to World War II efforts . . . he is highly commended for leading a great automotive enterprise to still greater potentials.

STARTING with Chrysler as resident attorney, Mr. Colbert became intrigued by the production techniques discussed at meetings of the corporation's top policy groups, and studied machine operations and blueprint reading at night school. This knowledge, added to his keen business sense, led to an appointment as manager of the Dodge-Chicago B-29 engine plant during the war, and later as Dodge president, Chrysler vice president, and finally its president.

Whether trading in cotton to pay for law education, operating the engine plant at unbelievable levels of efficiency, or directing and diversifying Chrysler's industrial activities, Lester L. Colbert's life has been one of energy, keen insight, and phenomenal organization know-how.

Joseph A. Siegel Memorial Award

Andrew E. Rylander

Technical Editor
Western Machinery and Steel World

Representative of a high level in Tool Engineers' dedication, loyalty, and sincere service to the Society's growth toward greatness . . . his editorial contributions are recognized for their substantial part in the development of ASTE's official journal toward true professionalism and prestige.

AN ASTE member since 1934, Andrew E. (Andy) Rylander has served as national director, editorial committee chairman, contributor to *The Tool Engineers Handbook* and, for several years, technical editor of THE TOOL ENGINEER. His personal column—"Andygrams"—had considerable bearing on Society growth. A trained shop man, inventor, and engineer, he is perhaps best known in the engineering and industrial world as a prolific writer. As such he has been a significant influence on the rising generation of tool engineers and to industry as a whole. He is a past president and life member of the Swedish Engineers Society of Detroit, having emigrated from Sweden at an early age. He is now a registered engineer in California.

500 Michigan members

As many tool engineers as the entire work force of the host factory—nearly 500—descended on the Keller Tool Div. of the Gardner-Denver Co., in the quietly industrious Lake Michigan town of Grand Haven on March 10.

Most of the machines were in operation, turning out the Keller line of portable air-powered tools, while the visitors toured the company's production and assembly plants. Ninety-seven Keller people acted as hosts and guides, taking the throng of ASTE members through in maneuverable and unhurried groups of eight or ten. The guests began arriving at 6 p.m. and were going strong until 11 p.m.

Sponsoring chapters in the western Michigan get-together were Grand Rapids, Muskegon, Kalamazoo, and Benton Harbor. Grand Rapids chartered buses to help send the largest delegation, 169, among the 475 total registrants.

Basic tools made at the respected Grand Haven firm are small air-powered drills, wrenches, hoists, grinders, riveters, ring formers, nut setters, and the popular and ingenious "Airfeedrills" and "Airfeed-tappers." The company's policy through the years has been to produce special tools on order rather than to mass produce general-use tools. The visiting tool engineers, therefore, got to view more than 100 different skills used in the widely varied production jobs.

ASTE members found no bleakness either in the Grand Haven weather, or in the Keller industrial climate. Company spokesmen were optimistic; they pointed out that the plants are on a three-shift basis, and that instead of layoffs there has been a slight pickup in hiring within recent months.

Further evidence, perhaps, of a booming hospitality was the smorgasbord served to the tool engineers in plant No. 3.

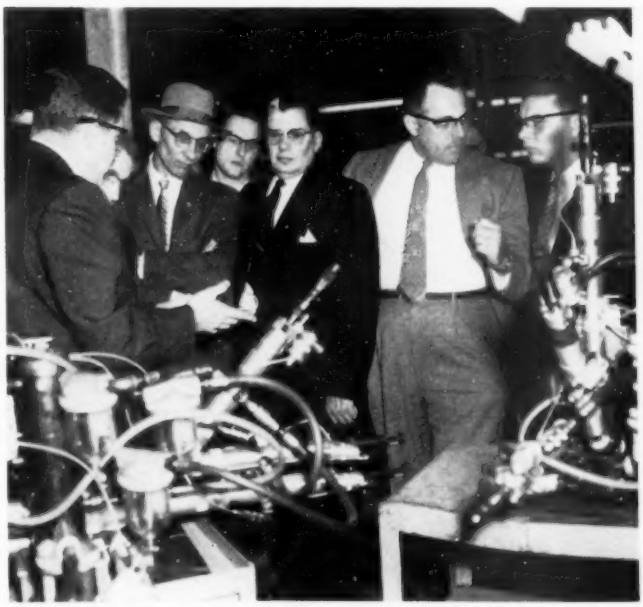
The Keller company was founded when Julius Keller started making air-powered chipping and riveting hammers in 1893. It moved to Grand Haven in 1917 from Fond du Lac, Wis., and merged with the Gardner-Denver Co. early in 1955. Their combined products are basic tools for oil, mining, construction and industrial companies.

Looking at automatic screw machine operation during Keller tour are (left to right) John Pridgeon, immediate past chairman of Western Michigan (Grand Rapids) chapter and vice chairman of the national membership committee; James R. Wagner, Jr., Grand Rapids program chairman who was most instrumental in arranging the Grand Haven tour, and who is incoming chairman of Chapter #38; and Dean Jon Adams of Ferris Institute. Dean Adams brought some 30 students with him.

inspect Keller Tool works

Separated a moment from the throng of 475 tool engineers who toured the Keller plants was this group of ASTE members from Grand Rapids. Reading left to right (front) are M. F. Morris, R. A. Kline, R. R. Miller, who is chapter membership chairman; Art Davidson, and Floyd Thompson; (back) R. B. McNee, R. E. Lubenow, J. I. Deckard, and E. L. Hoerner.

Posing before murals in lobby of Keller Div.'s No. 1 plant are (back, left to right) Brice Maddox, Keller vice president; Edwin A. Stouten, Western Michigan chapter's treasurer; James R. Wagner, Jr., program chairman; Clarence A. Elzinga of Kalamazoo, area captain of the national membership committee; and (seated) Sid Lenger, Gardner-Denver Co. sales engineer; Jack F. Jilek, new first vice chairman of Muskegon chapter; and John Pridgeon, Western Michigan past chairman.



Air-powered tools in foreground, product of the Keller Div. of Gardner-Denver, are explained by company guide to one of many small groups of touring tool engineers.

Production at the Keller plants went on without a hitch despite the unprecedented influx of ASTE members.

a look at the TODAYS of TOMORROW'S tool engineer

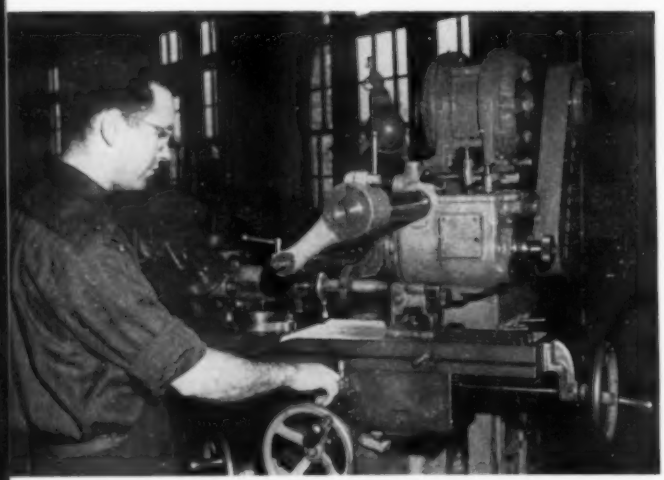
Jim Metcalf, chairman of the Wentworth chapter, takes care of the numerous details of running his chapter. Here he operates the movie projector purchased for showing industrial films used in weekly meetings.

campus hours and PRODUCTIVE PREDICTIVE

Meet James Metcalf, chairman of the Wentworth Institute student chapter, and typical of ASTE student members across the nation. Jim, while gaining scientific training in his chosen field of production engineering, is also being exposed to valuable organizational experience through his chapter office.

Extracurricular hours spent in learning group leadership, planning programs and conducting business meetings vie with classroom periods and shop time in their importance to the fledgling engineer who will soon answer the realistic challenge of the jet age. Thus will his ASTE activities become important stepping stones to a useful and creative future that carries the responsibilities of an adult world and yet demands the visions of youth.

Pretending to be Jim's shadow for a day gives us a pretty fair prediction of what his tomorrows will be . . .

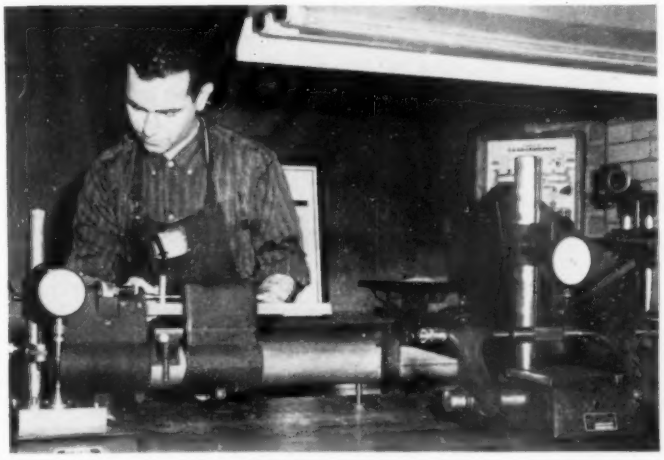


Jim's academic work includes machine-shop sessions where he will operate standard machine tools and study methods of manufacture that will serve him well in his future work. Here he is cutting a spur gear.

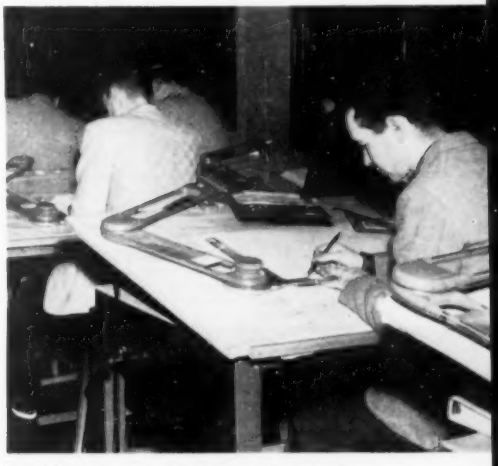
Instructor Arthur Goss watches as Jim gets some practical experience in making and pouring sand molds. A requisite for Jim's major, this course in casting processes covers all phases of foundry practice.

In the welding shop, students are trained in all types of fabrication from brazing to shielded arc welding. Jim, shown in one of the booths, about to start a project, has donned the protective attire prescribed.

Wentworth's chapter officers putting their heads together are: Clarence Vater, first vice chairman; Chairman Metcalf; Donald Lawton, second vice chairman; Ray Antetomaso, secretary; and Bob Fancy, treasurer.



The super micrometer which Jim is using here is part of the equipment provided in the measurement lab, where precision is considered the byword. Other production training includes courses in calculus, strength of materials, industrial management, and machine design.



Drafting courses for the student tool engineer include both tool and machine design. Actual problems are solved, using professional equipment.

Relaxation is a must, when both studies and outside activities center around something as mentally demanding as engineering. Jim's relaxation is shooting in team matches. He's also team secretary.

Typical weekly technical topic is plastic tooling, presented here by Raytheon representatives Andre Rodriguez, left, and Alfred Simon, second right. Jim and Adviser Charles Moody inspect samples.

The ASTE is getting big, so big that THE TOOL ENGINEER fears names will be buried by numbers. We don't want to lose sight of the fact that the Society, after all, is made up of 39,119 individuals. To revive the intimate perspective—to look at the trees despite the forest—here's some news that's not national or regional, or even chapter level, but strictly personal. It's the first in a series of profiles of your fellow tool engineers.

Meet the

PROBABLY the champion commuter in a whole nation of commuters is a tool engineer named William Gustave Meyer, member of Chapter 34.

He lives 1200 miles from his work.

I went to see him at his plant, and felt slightly humble because I had only come from Detroit, a mere 700 miles away.

Bill Meyer works in Yonkers, N. Y. He sort of feels at home on his job, he says, because Yonkers is such a commuters' town anyway, with thousands of them all around. The difference in him and them, though, is that Bill commutes *to* Yonkers, not from it. And an even bigger difference is that Bill stares out of the window on his way to work and counts states instead of stations.

Bill Meyer clutches a fistful of tickets for his 2400-mile round trip commuting. He gets nothing but smiles and service from the airline employee, because Bill's a steady $108 a week customer.

A few days after I visited him, I called him up about something and said: "How's the weather in Florida, Bill?"

The voice from Yonkers answered with some authority, "Lousy. Cold. Earmuff weather when I left home."

He lives in St. Petersburg, Fla., with his wife Gertrude; two daughters, Linda, 16, and Sharon, 8; and son Ronald, 12. Plus Mrs. Meyer's mother, two parakeets, and a cockatoo. Plus plenty of sunshine—usually—and plenty of water always.

Every Tuesday morning just past midnight Bill and his wife drive over to Tampa International Airport, where he boards a northbound airliner. Three and three-quarter hours later (with a tailwind), he steps off the plane at New York International Airport, climbs into his waiting car, and heads for Yonkers to begin another 3½-day workweek at Steel Slides, Inc.

Come Friday afternoon, back he goes to Idlewild, boards a plane, and four and a half hours later (bucking a headwind) arrives at Tampa to begin his three-day, four-hour week end in the sun.

During his workweek, the super-commuter lives at the home of his mother in Irvington, N. J.—handily solving the problem of room and board but adding quite a few miles to his weekly commutation total.

Add to all this the drive from St. Pete to Tampa, plus frequent midweek business flights and trips for his firm, and the total makes Bill quite a traveling

Champ Commuter

By M. L. Stone

man. Fifteen thousand miles a month is not unusual.

The happiest thought of all, as far as the average commuter is concerned, is the fact that Steel Slides picks up the tab for his long-distance hauls.

That amounts regularly to $108 a week, and it has been going on for almost eighteen months now. So one must assume, despite Bill's modest denials, that he is worth it to his company.

"I really put in more than a 3½-day week," Bill apologizes. "Flying time is thinking time for me. I take my job home with me."

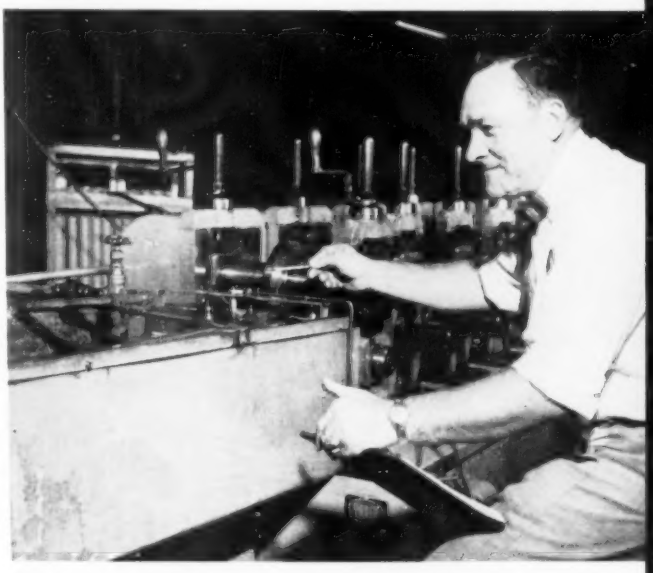
His job is chief engineer, engineering consultant, and plant supervisor of the small plant located in one of the hollows in the complex of hills and hollows along the Hudson River that comprises the city of Yonkers. The firm manufactures steel slides used in opening and closing dining tables, phonographs, etc.

Bill is in charge of developing new products. He designed the ingeniously simple slide mechanisms, and proudly points out that his firm has sold 30 percent of the furniture industry since production began less than four years ago.

He's also proud of the fact that he has designed virtually a scrap-free operation. Out of 2000 pounds of specified strip steel, only one slide—about 40 inches of it, where the strips are butt-welded—is tossed aside for scrap. Out of every 100,000 pounds of steel, rejections for all reasons average only 187 pounds. The patented Steelslides are torturously roll-formed and fabricated into compact telescoping units that attach to the underside of the table top. The units interlock and overlap to form rigid, extensible, self-supporting "backbones" which Bill defies you to sway—outmoding legs and stopping dining table tug-of-wars, he says.

Bill modestly asserts that one fork lift does the most work in the shop, and Bill Meyer does the least. He designed the special automated tooling setup for the product.

He has been with Steel Slides since its inception, but has worked for other divisions of the corporation—mostly with Hydra-Power, Inc., of New Rochelle, makers of hydraulic and pneumatic control devices for aircraft—for 13 years. During the war he was with General Electric's Bloomfield works, helping design the remote control gunfire



On the job at his Yonkers, N. Y., plant, Bill Meyer points to one of the many spring-loaded safety devices —"mousetraps" to him—which he has rigged up to shut off his pride and joy machines in case of troubles while he's at home in Florida.

apparatus for the B-29 bomber. After the war he went to Hydra-Power, as plant superintendent, and stayed until Steel Slides was incorporated in 1953.

Bill grew up in New Jersey, finishing high school in Caldwell. He attended Newark Tech and continued in various technical schools in the area. He's proud that he is mostly self-educated in his highly complex career. So what is his advice to youths interested in metalworking and engineering careers? Get the most formal schooling, from the highest rated schools, that's possible.

He holds several patents on inventions of his own, and is his employer's specialist in automation. He has designed the current product, and the tools to produce it, with such skill that a prospering payroll has been built around it.

So when he tried to quit and move to Florida a year and a half ago, Steel Slides stopped the presses and took quick stock.

The Meyer family had been taking vacations in Florida for years, and had been wondering for years how they could live the southern life full-time. Finally they decided they'd move, and Bill would find work with one of the new industrial families along the Suncoast, their favorite region.

Steel Slides said no to his leaving them but okay to his moving, and told Bill to work out any feasible arrangement for living in Florida and working in New York. They offered to buy him a plane—he holds a pilot's license—but he chose to use commercial airliners because of the greater ease and higher speeds.

In February of last year the Meyers sold their house in Clifton, N. J., and moved to a new one in the new South Causeway Isle development in St. Petersburg. They look through a picture window at their dock and vivid blue water now, go riding in their boats, soak up sun, swim; daughter Linda works on her first novel; son Ronnie shares his hobby, electronics, with his dad on week ends; daughter Sharon just plays and gets browner. And Mrs. Meyer says simply, "We like it here."

Bill is breezy, friendly, as dynamic as one of his pet spring-loaded "mousetraps"—safety devices—that he has poised on his fifty-foot-long slide-fabricating machine. He's a bow tie wearer and a fast talker. He dismisses his marathon commuting with a shrug.

"Commuting isn't a matter of distance but of time. Satisfaction with the job comes first with me. This long-distance commuting is worth it to me, so long as it's worth it to the company.

"I've got a family up here in Yonkers too. I've been working with these fellows so long that in some ways I'm as close to them as to the family."

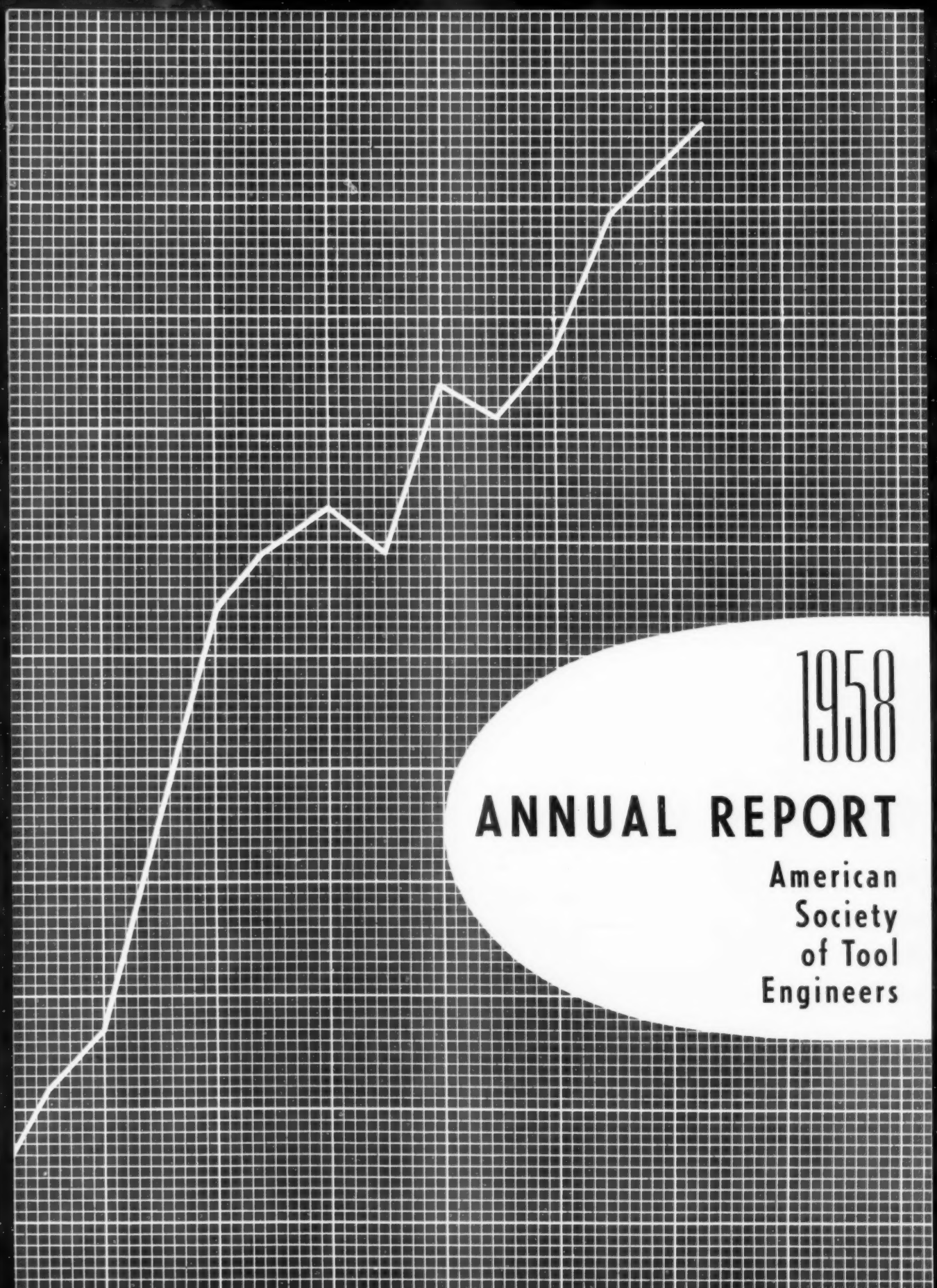
Bill joined Chapter 34 last fall. He saw some literature on the ASTE and followed through to membership, because he saw where it would help his job and his future. For Bill didn't move to Florida to retire; he gets along fine with his preponderantly octogenarian neighbors in the shuffleboard city of St. Petersburg, but he lets them know he's still only 40 and still flying high.

Asked what he likes to do most on his week ends at home, Bill wrinkled his brow briefly, then grinned and said dutifully:

"I like to read THE TOOL ENGINEER."

Here's one of the main reasons the Meyer family moved south. Enjoying boat, sun, and blue water are Ronnie, Linda, Sharon, Mrs. Meyer, and Bill. Their home has private dock and picture-window vista of the bay.

Bill Meyer spends a good deal of time at his drawing board during his 3½-day workweek—and a good deal of his week ends thinking about his drawing board, he adds. Right is Mel Stone, of *The Tool Engineer* staff.



1958 ANNUAL REPORT

American Society of Tool Engineers

148 Society Chapters

serve strategic industrial areas

ASTE CHAPTERS

1. Detroit
2. Racine
3. Cleveland
4. Milwaukee
5. Chicago
6. Fairfield County
7. Hartford
8. Pittsburgh
9. Toledo
10. Buffalo-Niagara Frontier
11. Twin Cities
12. Rockford
13. Baltimore
14. Northern New Jersey
15. Philadelphia
16. Rochester
17. St. Louis
18. Dayton
19. Syracuse
20. Schenectady
21. Cincinnati
22. Central Pennsylvania
23. Tri-Cities
24. Elmira
25. Worcester
26. Toronto
27. Los Angeles
28. Golden Gate
29. Houston
30. South Bend
31. Peoria
32. Springfield (Mass.)
33. Boston
34. Greater New York
35. Binghamton
36. Columbus
37. Indianapolis
38. Western Michigan
39. Seattle
40. Twin States
41. New Haven
42. Hamilton
43. Nashville
44. San Diego
45. Fond du Lac
46. Portland (Maine)
47. Akron
48. Potomac
49. Williamsport
50. Montreal
51. North Texas
52. Wichita
53. Little Rhody
54. Louisville
55. Windsor
56. Fort Wayne
57. Kansas City
58. Decatur
59. (Inactive)
60. New Orleans
61. Atlanta
62. Erie
63. Portland (Oregon)
64. Springfield (Illinois)
65. Niagara District
66. Richmond
67. Phoenix
68. Saginaw Valley
69. Oakland County
70. Muncie
71. Cedar Rapids
72. Fox River Valley
73. Evansville
74. Mid-Hudson
75. Madison
76. Springfield (Ohio)
77. Denver
78. Mohawk Valley
79. Ann Arbor Area
80. Des Moines
81. Grand River Valley
82. Piedmont
83. Lehigh Valley
84. Long Beach
85. Salt Lake City
86. Granite State
87. Jackson
88. Long Island
89. Greater Lancaster
90. Tulsa
91. London-St. Thomas
92. Los Alamos
93. Albuquerque
94. Peterborough
95. San Gabriel Valley
96. La Crosse
97. Lima
98. Santa Clara Valley
99. San Fernando Valley
100. Northern Massachusetts
101. Keystone
102. Paterson
103. Nebraska
104. Louis Joliet
105. Memphis
106. Tucson
107. Knoxville-Oak Ridge
108. Chautauqua-Warren
109. Lansing
110. Canton
111. Muskegon
112. Calumet Area
113. Merrimack Valley
114. Hendrick Hudson
115. Western Reserve
116. Kalamazoo
117. Battle Creek
118. Southeastern Massachusetts
119. Santa Ana Valley
120. Benton Harbor-St. Joseph
121. San Antonio
122. Riverside
123. Little Rock
124. Monadnock
125. Oklahoma City
126. East Texas
127. Ashtabula County
128. Northwestern Pennsylvania
129. Centinela Valley
130. Monmouth
131. Elkhart-Goshen
132. Schuylkill Valley
133. Raleigh-Durham
134. Lorain County
135. Mansfield
136. Ottawa
137. Kokomo
138. Trenton-Delaware Valley
139. Ozark
140. Southeast Kansas
141. Mississippi
142. Macomb County
143. Birmingham
144. Sydney, Australia
145. Sacramento, Calif.
146. North Shore, Boston, Mass.
147. San Francisco, Calif.
148. Central Connecticut

ASTE STUDENT CHAPTERS

University of Michigan
Utah State College
University of Kansas
Wayne State University
Alfred State Technical Institute
Purdue University
Wentworth Institute
Franklin Technical Institute
City College of New York
Mohawk Valley Technical Institute
Lawrence Institute of Technology
California State Polytechnic College
Canton Ag. & Tech. Institute
University of Wichita
Long Beach City College
Southern Technical Institute
Hudson Valley Technical Institute
Rochester Institute of Technology
Oregon State College

ANNUAL REPORT

Fellow Members of ASTE:

Here is a condensed report of the year's work of our various national committees, along with figures and charts showing the American Society of Tool Engineers' growth and financial status. I hope you will read the report closely—for it is *your* Society, after all, spending *your* money and exerting *your* energies for what the leadership interprets to be your needs, scientific, technological, and professional.

With the chartering of our 148th senior chapter and our 19th student chapter, and with the membership now totaling 39,000, the Society has proved it can continue its gratifyingly rapid growth even during a year when industry has been forced to retrench. This growth in size, and a concomitant growth in stature, is effective evidence of the continuing need for increasing production and decreasing costs—and of the vital role such a society as ours plays in this dynamic process.

The following summaries of the work of your leaders do not do justice to the imagination they have brought to bear on our problems; to the labor they have expended, or to their dedication. They should indicate, however, the highlights of the 26th year of the Society's existence.

COST OF SERVICE PER MEMBER PER YEAR*

(based on fiscal years 1955-56 and 1956-57)

Scientific & Engineering Expositions	$ 4.19
Conferences on Science & Engineering	.92
Reference Publications on Tool Engineering Science	1.88
Periodical Publications on Tool Engineering Science	25.99
Engineering and Educational Research	.78
Engineering Regulatory Research	.25
Engineering Data Service	1.27
Technical Information Services	1.05
Scientific & Engineering Program Planning	.78
Standards Research	.68
Awards for Science, Engineering, Research	.13
Operations (Office; Finance, Judicial, Constitution & Bylaws activities; officers and directors)	7.64
Membership Activity	.69
Total	$46.25

INCOME PER MEMBER PER YEAR

(based on fiscal years 1955-56 and 1956-57)

Scientific & Engineering Expositions	$ 9.63
Engineering Data Service	1.10
Reference Publications on Tool Engineering Science	.96
Periodical Publications on Tool Engineering Science	30.21
Conferences on Science & Engineering	.36
Membership Dues	4.81
Initiation Fees & Miscellaneous	3.52
Total	$50.59

*Average membership during the period was 36,588

The strong financial structure of the Society, with a net worth of $1.3 million, is portrayed in the balance sheet at the top of the next page.

The figures for income and expense above illustrate the multiple dividends each member receives in addition to invaluable technical and scientific information. With an average dues payment of $4.31 going to Headquarters (a portion of the original outlay for dues goes back to the chapters), each member receives services in various forms from the Society amounting to $46.25, a return of 760 percent on his investment in National operations.

Society research expenditures are not represented above because they were drawn from ASTE allocations of the previous year, augmented by funds provided from industry.

BALANCE SHEET FEBRUARY 28, 1958

ASSETS

Cash	$ 135,435.55
Treasury Bills	721,474.00
Accounts Receivable	44,201.86
U.S. and Canadian Government Bonds	466,962.00
Common Stocks at Cost	153,911.86
Inventories	96,308.27
Property and Equipment	276,847.88
Expenses Paid in Advance	4,388.61
	$1,899,530.03

LIABILITIES AND NET WORTH

Liabilities	
Unpaid Normal Expenses	$ 61,768.46
Deposits—Future Business	515,495.33
Accrued Personnel Expenses	10,553.57
Unpaid Sales Commissions	855.00
Special Award Deposits	2,245.00
Reserve for Bad Debts	1,250.00
Total Liabilities	$ 592,167.36
Net Worth	$1,307,362.67
Total Liabilities & Net Worth	$1,899,530.03

Finance: Existence of the Society and its ability to serve its members are dependent upon the state of its finances. The financial committee studies trends of assets, liabilities, reserves, income and expenses in its attempt to safeguard and bolster the financial structure of the Society.

Despite a year of economic recession which saw the ASTE's expenses exceed its income slightly, the balance sheet reproduced in this report shows the Society's solid financial footing—total assets of $1.89 million and a net worth of $1.3 million.

Tables for income and expense are represented on a per member basis, covering two preceding fiscal years in order to average the biennial Industrial Exposition on an annual basis. Based on an average membership of 36,588 for the two fiscal years, services to the profession and to industry amounted to $46.25 for each member. This was accomplished with an average per member investment of $4.81, representing a 760 percent return on each investment.

Research: The Society's research program strives to contribute outstanding and worth-while information to industry, and to the American way of life. The program has gained increasing acceptance. The steering committees and subcommittees of the various research projects are indebted to industry for giving so generously of its time and talent.

Three research projects are being completed at this writing. The final report from the Columbia University project covering temperature distribution during metal-cutting has just been issued. A study of metal borides at the Armour Research Foundation has ended and the final report is expected soon. A project at Massachusetts Institute of Technology on cutting fluids is also drawing to a close.

Other research projects currently underway include metal-cutting, plastic tooling, and metal stamping.

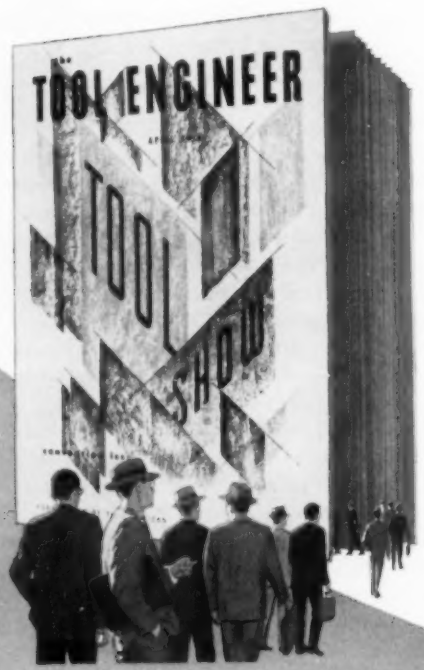
Professional Engineering: The entire Society benefits by the professional growth and development of the individual members. The professional engineering committee has three basic objectives: first, to encourage the professional growth of tool engineers whether they become registered or not; second, to cooperate with the Government agencies to promote recognition of tool engineering as a profession; and third, to assist ASTE members to qualify for registration by making refresher and preparatory courses available to them.

To facilitate its work toward these objectives and to more properly serve the Society membership, this committee has been organized on a regional basis with the eight members sharing an approximately equal number of the Society's 148 chapters. During the past year four chapters have affiliated with local engineering councils. Much of this activity is traceable directly or indirectly to activities of the committee in encouraging such affiliation.

Editorial: Technical articles in THE TOOL ENGINEER are selected to meet the widely diversified needs of Society members. These articles have fallen under the following general subject categories: tooling, processes, design engineering, materials, management, inspection and quality control, materials handling, cutting fluids and lubricants, and miscellaneous.

The general editorial operations of the magazine are constantly being studied by the staff. Further, to insure the tool engineer's development in the right direction, measurement of the editorial effectiveness is a continuing process through readership surveys, through the editorial committee chapter contacts and editorial reprint and publicity requests. Such studies and reactions help to indicate which sections and what subject matter are most widely read.

The ASTE News Section keeps the membership posted on important projects and events through feature articles. Special consideration has necessarily been given to the more newsworthy activities of the chapters as growth of the Society continues. A definite effort has been made by editorial committee members and the news staff to get more response from student chapters.



Membership: The most important asset of the Society is its membership. Upon the size and vitality of this membership hinges the Society's success in serving the profession and in achieving public recognition. The ASTE has become one of the largest engineering organizations in the country in its 26-year history. Now representing some 39,000 members, our roster includes 148 chapters in strategic industrial areas of the United States, Canada, and Australia. In addition, there are as of this writing 19 student chapters serving tomorrow's tool engineers. The Society has gained better than 1500 members since this time last year.

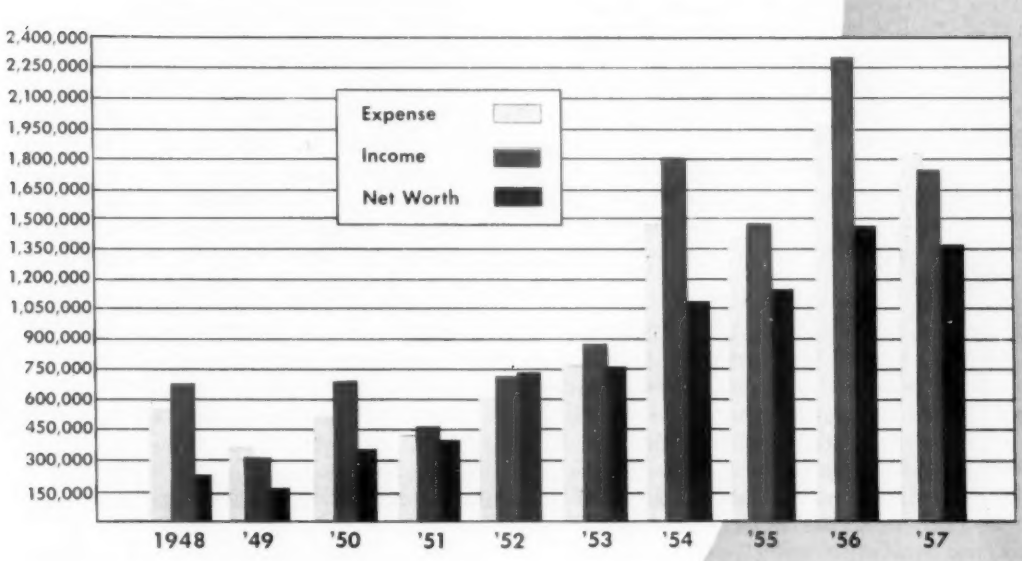
Since the last annual report, four senior chapters have been chartered: Sacramento, North Shore, San Francisco, and Central Connecticut. Three new student chapters have been launched: Hudson Valley Technical Institute, Rochester Institute of Technology, and Oregon State College.

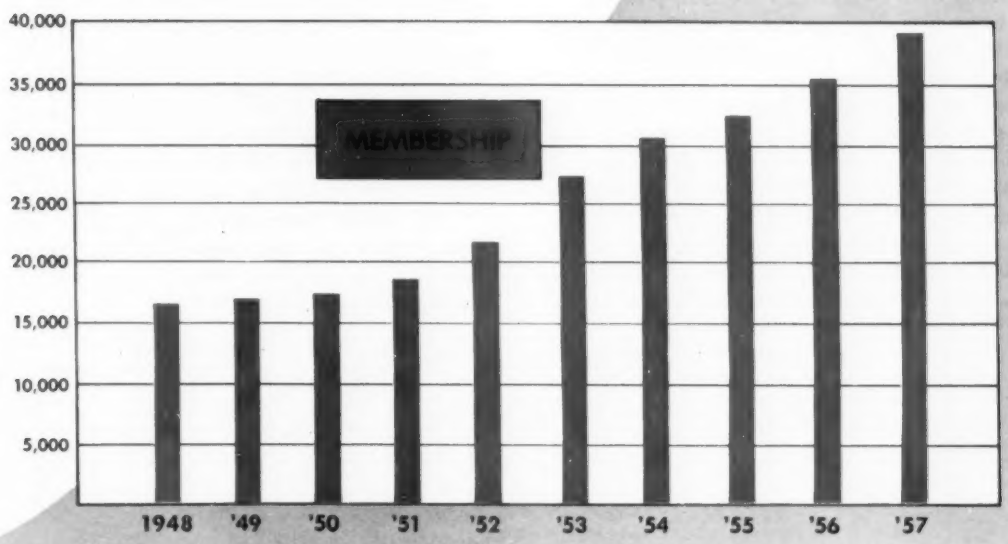
The membership committee is completing its first year under a reorganized structure. The committee now consists of a national chairman and seven vice chairmen, known as the operational part of the group. The other section of the committee is the functional group and is made up of various area captains selected by the seven vice chairmen. At present, there are 23 men in this capacity.

These men have bent their efforts with considerable success toward correcting the drop in chapter membership in some areas, occasioned in large part by economic conditions during the past year. They have instituted a program to curtail nonpayment removals from the rolls, and they have stressed an effective program of follow-up of delinquents. The committee believes that the leadership conference held in conjunction with the Annual Meeting will help counteract the scattered losses in membership.

Stressing "quality with quantity" in membership efforts, the committee has worked for more rigid adherence to membership qualifications. It has encouraged closer screening of all applications at headquarters, and has revised the application blank to aid chapters in determining more easily the proper grade qualifications of applicants.

OUR GROWTH
at a glance
1948 — 1957





Honor Awards: Recipients of the Society's six national honor awards, as selected by this committee, are the following: J. E. Hollingsworth, dean of the business and technology division, Long Beach City College, Education Award; Dr. Max Kronenberg, consulting engineer of Cincinnati, Research Medal; Jesse Daugherty, staff vice president—engineering, Giddings & Lewis Machine Tool Co., Engineering Citation; Andrew E. Rylander, technical editor of *Western Machinery and Steel World*, Joseph A. Siegel Memorial Award; L. L. Colbert, Chrysler Corp. president, Progress Award; and Prof. Milton C. Shaw of the Massachusetts Institute of Technology, Gold Medal.

Sculpture of the new chapter-level Award of Merit has been completed. Recipients will be named at the Annual Installation banquet; actual conferment of the plaques will be made at chapter meetings later in the year.

Education: The aims of this committee are broad indeed, as broad as education itself. These objectives are to develop tool engineering education interests at the technical institute, junior college, and secondary school levels; to develop direct educational programs to assist individual members; to stimulate cooperation between industry and education; to foster the science of tool engineering in colleges and universities; and to assist the chapters with educational programs.

Major steps have been taken toward these ends. Development of a course of instruction in die design, extension of the scholarship program, provision of the latest applied science information on tool engineering subjects through seminars and lecture series have all contributed directly to the fundamental reason for the Society's existence, "the advancement of scientific knowledge in the field of tool engineering."

More specifically, the committee has fostered advanced tool engineering practice series in three cities and, in cooperation with two chapters, has sponsored seminars on ceramic tooling. Plans have been made for additional seminars in six subject areas for the coming year. The on-campus conferences continue as one of the most successful projects of the committee. Such conferences were held on eight campuses during the year; they will be held again at the same schools in the coming year, and in addition at six others.

The growing complexities of the Society's educational interests led to the appointment this past year of a full-time national education director.

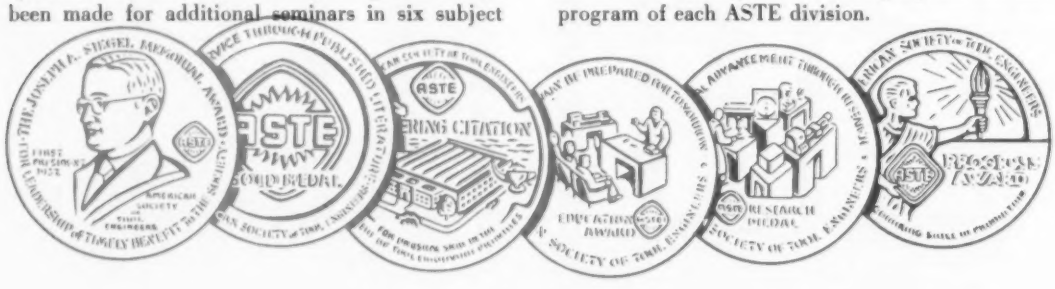
Constitution and Bylaws: Among approved amendments to the Society bylaws are a change of name of the book committee to the technical publications committee, on both chapter and national levels; and designation of the incoming chapter chairman and first vice chairman as the delegate and alternate delegate, respectively. Recommended amendments are establishment of a deadline for receipt of petitions from candidates for national director, and creation of an additional standing committee to be known as the exposition committee.

The constitution and bylaws committee is currently studying the problems of whether to move up the date for complete reprinting of the revised constitution and bylaws from the scheduled 1961 publication, and whether to conduct the election of national directors by mail ballot of the membership.

Progress: As its name indicates, this committee aims to point out ways the Society can progress. Certain members of it are members by virtue of their office in the ASTE. The consensus of the committee is that this membership should not be changed every year, in the interest of continuity of thought and in view of its somewhat unique role.

The committee is seeking to analyze the technical interests of ASTE members in order to determine how best to meet the members' needs.

Another project of the committee has been a study of the composition, activities, and expenditures of national committees. The progress committee's report has been recommended to the national board as a guide in developing the size and program of each ASTE division.



Technical Publications: Society authorization of an expanded book-publishng program is reflected in the activities of this committee during the past year. The technical publications editorial staff at Headquarters has virtually completed a thorough revision of *The Tool Engineers Handbook.*

Technical publications either already off the press or in active compilation include the following: *Tooling for Metal Powder Parts; Handbook of Process Planning and Estimating;* and *Jig and Fixture Design.*

Books now in the planning stage include: *Machining With Carbides and Oxides; Numerical Control of Machine Tools;* and an aircraft tooling manual.

Programs: The largest technical program ever presented by the Society—more than 90 papers comprising the first metal-cutting review seminar and symposia on numerical control and tooling for metal powder parts—was planned by this committee to be presented in conjunction with the 1958 Annual Meeting in Philadelphia. In addition, thirty plant tours were arranged for this meeting, together with a complete ladies' program.

Preliminary planning has been done for the semi-annual meeting scheduled in Los Angeles in September, 1958. Emphasis in the technical program there will logically be placed on papers on aircraft and missile subjects. Fourteen plant tours have been arranged.

The primary objectives of the program committee set forth at the beginning of the year were: improvement of programs at the chapter level; improvement and expansion of national meetings; and improvement of publication and distribution of collected papers. On the chapter level, the committee conducted fourteen program clinics in the organizational zones under which the committee operates. These clinics throughout the country were attended by 76 percent of the chapters. The committee is enthusiastic about the result, and is staging the clinics again in 1958.

Public Relations: This committee is responsible for keeping the public informed about the Society, and for maintaining goodwill.

Activities of the committee and the information services staff at Headquarters during the past year have included staging of the closed-circuit broadcast during the Silver Anniversary celebration at Houston; distribution of the revised chapter public relations kit; inception of a "grass-roots" public relations program among the chapters; completion of the first slide film in a series on tool engineering and the ASTE; setting up of an orientation program for new members; completion of a chapter bulletin survey, and analysis and distribution of the results; and designing of a portable display kit for chapter use.

Standards: This committee represents the Society in all standards activities of other national and international organizations such as the American Standards Association, Canadian Standards Association, and Joint Industry Conference. With the inception of the chapter in Australia, British and Australian standards now become part of the scope of the committee.

Through a sectional committee of the ASA, the Society is participating in projects of the International Standards Organization. The committee hopes to put this participation on a more direct basis in the near future.

The ASTE has recently published a proposed American standard on diamond dressing tools. This proposal has been submitted to the ASA mechanical standards board as the first step in gaining ASA approval.

The Society committee is working with the ASA, also, toward publication and approval of an American standard on tool steel classification.

Through its carbide subcommittee, an American standard on single point tools and tool posts has been completed and approved. The subcommittee is working on two other proposals, drill and reamer blanks and roller turner tools, which it expects to complete in the next year.

Conclusion: I believe the Society's affairs have been conducted in an honest and business-like manner, and I sincerely hope that future years will bring as much satisfaction to my successors as the past year has to me. I am proud to have served at the head of an organization like the ASTE. And I am grateful to all those who have done so much to make my responsibilities lighter and the Society's accomplishments greater.

Submitted for and on behalf of the Board of Directors and National Officers

H E Collins

President and Chairman of the Board

There are days when a dog,
if not man's best friend,
is at least his wife's best,
and only, companion.
That is, if the man is a never-stay-home kind
of tool engineer executive.
Here, Mrs. Tool Engineer "and friend"
tell readers how they feel about it.

an aste wife speaks up

"What Tool Engineering

How does an ASTE wife feel about her husband's job? Does she appreciate its pressures and responsibilities? Does she resent those hours spent away from home, and yet encourage him to devote even more time to professional groups such as ASTE?

We thought we'd ask one of these wives (whose husband, incidentally, has made an impressive rise in the manufacturing world, and who has always, it seems, had his finger in the ASTE pie) just what tool engineering, and ASTE, have meant to her.

Let's first take a look at Maudie, as she is called by all who meet her. Shaking her hand in the receiving line of some Society function, and being exposed to her crinkling brown eyes and her hearty southern drawl, "And haow are *you?* Ah'm *so* glad to meet you. Mah name's Maudie," it's impossible to come away with any other impression than that this is one of the most genuinely sincere and friendly persons you have met in a long time. You envy her enthusiasm, and admire her obvious pride in her husband and his place in the Society. Her husband, I might add, has just as much pride in her, his most ardent and loyal fan.

"You want to know how I feel about being an engineer's wife?" she asked, when we solicited her

A gracious hostess at Society doings,
Maudie counts among her friends
the many other ASTE wives
she has met during the twenty years
her husband has been associated with the Society.
Here, she and another member's wife
Mrs. Paul E. Brainard, check
through the guest book at a meeting

thoughts on being married to perhaps one of the busiest tool engineers and hardest working ASTE'rs we know. "Well, I'll tell you.

"When I married, my husband was like the proverbial 'small frog in a big puddle'—his company. We had plenty of time for sports, parties, theatres—all the things young people like doing together."

Sports, by the way, have always played an important part in their lives. Maudie plays a championship game of golf and table tennis, and was a star on the local softball team for years, while her husband, holder of a number of golf club championships, also has kept active with baseball and volley ball.

"I was just thrilled when he got promoted," Maudie relates, and you can be sure, in her exuberance, that she was *just* that. "Life didn't change, except that maybe we enjoyed a higher standard of living which his promotion made possible.

"Then came his intense interest in his chosen profession, and more promotions, which meant he had to travel a lot more. Our usual routine was upset, and it *did* take some getting used to. In a way, I suppose I resented this new life of my husband's which excluded me. His being constantly on the go—flying across the country to attend meetings, to give talks promoting his profession, or to conduct company business—put quite a crimp in our social calendar, and a definite void in our life together. I wondered, now and then, if perhaps I shouldn't have married a stay-at-home."

Maudie and her mate, Mr. President, look forward to more time spent together at home after a hectic trip-filled year.

has meant to me."

During the times her husband was away on business, Maudie didn't sit and fret, however. In her own efficient way she read his mail, handled what she could, and forwarded the more urgent letters to him, wherever he was. This was an important factor in her realization of the importance of his job. She relates another incident that brought into focus just what her husband's work, his trips, and his devotion to engineering meant to him, and to others.

"One day, by accident, I heard a talk on the radio about engineering and how vital it is in this age, when our whole economy is based on manufacturing and, behind that, on the engineering that makes the manufacturing possible. I began to sit up and take notice, then, of all branches of engineering, and was amazed to find how many things engineering is involved in, and how vital it is in the advancement of nuclear energy, sputniks, and the like.

"My husband's keen interest in ASTE for the past 20 years has naturally rubbed off on me. And meeting other men in his profession, along with their wives and families, has provided experiences, friendships, and pleasures that others might not gain in a whole life span."

Maudie gives a word of advice to other wives who might feel as she once did—that such an exacting profession takes too much away from marriage, and a home. "Do as I did! Take time to learn more about this interesting world of engineering. For with knowledge, both of your husband's job and of the professional organizations to which he belongs, comes pride—in him, and in his chosen field. I'm just *one* of the many women who have looked for, and found, this knowledge, this interest, and this pride—and along with them, a host of friends I would otherwise never have known."

These are the words of Maude Collins, ASTE's first lady during the year just past. And who could be better qualified to speak for the rest of the women who, like her, have to share a husband with both his job and with the time-consuming claims of a technical society like ASTE, and find that they are richer, not poorer, for the sharing?

Harry A. Paine

Dan E. Harrison

Harry A. Paine, Detroit senior member and chairman of the national program committee, has become vice president and sales manager of the small tool department, Federal-Bryant Machinery Co., following merger of Federal Machinery Sales and Bryant Machinery and Engineering. **Spencer B. Booz**, also a Detroit member, will head the newly merged organization.

The appointment of **Dan E. Harrison**, Racine chapter, as vice president and general manager in charge of the Midwestern Div. of True-Trace Sales Corp. was announced recently by the El Monte, California, firm, which designs and manufactures hydraulic and machine tool controls.

As vice president, Harrison will direct the operations of the Racine, Wis., and Westbury, Long Island, N. Y., plants. He will supervise dealer operations in addition to the sales and servicing of 27 midwest and eastern states.

Mr. Harrison joined True-Trace in 1956 as general manager of the Midwestern Div. He was formerly associated with National Steel & Shipbuilding Co., where he organized the Aircraft Div., specializing in profile machining for prime aircraft manufacturers.

Martin C. Butters, member-at-large, has been named executive vice president of Brubaker Tool Corp., Millersburg, Pa. Mr. Butters will also direct operations of the Morton Machine Works, a wholly owned subsidiary of Brubaker, recently purchased by that company and moved to the Millersburg area. Mr. Butters has served in the machine and cutting tool industry for more than 35 years.

Among other personnel title changes at Brubaker was that of George N. Fairchilds, who was made vice president in charge of sales.

Morse Twist Drill & Machine Co. has appointed **R. G. Brodersen**, Cincinnati, district manager in the east-south trading area, with headquarters in Nashville.

F. N. Martin, Jr.

Clyde N. Simpson

members in the NEWS

Buhr Machine Tool Co., Ann Arbor, Mich., announces the establishment of direct sales representation in the Detroit area by **Fred N. Martin, Jr.** of the Ann Arbor Area chapter.

Martin is an industrial mechanical engineering graduate from the University of Michigan. He joined Buhr Machine Tool Co. in 1946 as a machine designer and worked in that capacity until 1950 when he was appointed sales engineer.

Clyde N. Simpson of ASTE's Northern Massachusetts chapter has been appointed Detroit district manager for the Union Twist Drill Co. For the past few years Mr. Simpson has been superintendent of the cutter shop at the Athol, Mass., Div.

Formerly associated with General Electric, having graduated from their apprentice training school in 1940, he served as supervisor of their Methods Department and assistant plant superintendent of General Electric, Holyoke Div., before coming to Union Twist Drill.

The Machinery Div. of Racine Hydraulics & Machinery, Inc., has announced the appointment of **Wallace E. Swan** of the Racine chapter, as division sales manager.

The Carpenter Steel Co. has appointed **Gerald R. Garinger**, Toledo, assistant branch manager of the Toledo mill-branch warehouse.

The appointment of **Esmonde J. Bushey**, of the Northern Massachusetts chapter as assistant works manager of the Union Twist Drill Co.'s Athol Div., was announced by President Stanley L. Holland. His duties will include those relinquished by Mr. Simpson.

Mr. Bushey has been associated with the Waltham Watch Co. as a design engineer, and later as head of their entire experimental department. Since March, 1947, he has been with Union Twist Drill as a design engineer and later as chief engineer, prior to his new appointment. His more recent duties included material assistance in setting up new and modern methods in a recently acquired West Berlin subsidiary.

Esmonde Bushey

G. E. Trevaskis

Chris F. VanRaaphorst, New Haven, formerly with the Waterbury Mfg. Div. of Chase Brass, has joined the Bridgeport Brass Co. as manager of its Norwalk (Conn.) plant.

A veteran of many years' experience in the non-ferrous metals industry, Mr. VanRaaphorst was plant superintendent of the Chase subsidiary and prior to that was plant superintendent for the Waltham Screw Co. of Waltham, Mass. Earlier, he was New England sales manager of the Mueller Brass Co.

A native of Amsterdam, Holland, Mr. VanRaaphorst came to this country when a child. He attended Franklin Technical Institute, Boston, and Wilbur Wright Technical School in Detroit, Mich. He is a member of the Bridgeport Tool Engineers Association, the Connecticut Non-Ferrous Foundry Association, the ASME and the ASTE.

Norman B. Watkins, immediate past chairman of San Fernando chapter, has accepted a position as chief engineer with Technibilt Corp., Burbank, Calif.

G. Edward Trevaskis was elected executive vice president of the Detroit College of Applied Science. Experience gained by 20 years in the automotive and aviation industry is being put to use in his present position.

In the national SPOTLIGHT

ASTE leaders and special visitors watch an electric accounting machine running off membership roster during their tour of Society Headquarters at Detroit April 7. Left to right are Harry E. Conrad, executive secretary of ASTE; George Eaton, executive secretary of the National Tool & Die Manufacturers Association; George Goodwin, ASTE vice president; ASTE President H. E. Collins; Ludlow King, executive vice president of the National Machine Tool Builders Association; Alfred Bodine, president of NMTBA; and Philip Marsilius, president of NTDMA and an ASTE director. Purpose of the get-together was a better understanding of the various organizations mutual areas of activity.

Metal Powder Handbook Published

"Tooling for Metal Powder Parts," a one-volume source book of information on the subject of powder metallurgy by George H. De Groat is ASTE's most recent contribution to the world of bound technical publications. It is the first of the Society-sponsored handbooks to have been professionally written by one author.

Upon its introduction at the Tool Show May 1, it will provide usable, factual data to the product designer, process planner and tool designer who must weigh the pros and cons of the new manufacturing technique and decide whether or not its economies and other advantages overshadow its limitations.

The process known as powder metallurgy gained great impetus during World War II when it was able to meet the exceptional demands of wartime output, and has since become, through new developments in powders, equipment, and technique, one of the leading metalworking methods for high volume production of machine tool parts.

Although considerable literature has already been published on the subject in the form of technical articles, engineering papers, and books covering a specific phase of the process, there has long been a need for a ready reference, under one cover, for the planning and tooling called for in producing powder metal parts. This volume stands ready to fill that need.

Seventeen official reviewers, experts in their fields, have passed on the professional accuracy and technical usefulness of the book, which has been approved by ASTE's national technical publications committee, headed by Francis J. Sehn.

Conforming in format to the other ASTE handbooks, the blue-bound volume runs to 253 pages, and carries a price of $6 to members and $7.50 to nonmembers. A limited number of advance copies will be available at the Convention in Philadelphia. Orders for other copies will be filled through requests to headquarters.

chapter news and views

MOHAWK VALLEY—At the recent automation conference at Mohawk Valley Tech, Speaker William Bibler, Genesee Machine Co., holds an automatic cylinder for study by MVTI prexy, Albert V. Payne; Richard Lautetbach, chapter chairman; and two of the other speakers, Robert Stewart, Drop Forge; and Robert Seigle, GE.

Automation Conference Caters to Needs Of Small Volume Producers at MVTI

Automation for low volume production was the theme of an all-day conference jointly sponsored by the Mohawk Valley Technical Institute and the Mohawk Valley Chapter #78 American Society of Tool Engineers on March 8th at MVTI. The theme had special significance for area manufacturers, since most factories in the Mohawk Valley use a job shop method of production, with the manufacturers concerned with automating single machines rather than an over-all production line.

Speakers included Chester Linsky, Pennsylvania State University; Robert Stewart, Utica Drop Forge & Tool Corp.; William Bibler, Genesee Machine Builders, Inc., Rochester; and Robert Seigle of General Electric.

Professor Linsky, lead-off speaker at the seminar, talked about low cost automation and the small manufacturer. He outlined some fundamental rules the small manufacturers should consider before setting up an automation program: (1) Analyze the business and reduce it to its fundamentals; (2) Prepare a financial estimate on both project costs and savings (3) Approach each project from the viewpoint of what automation can save, rather than what can be automated; (4) Never be satisfied with accomplishments.

Robert Seigle, supervisor, advance manufacturing development, GE, described the automationist as a dreamer, the thinker-upper, the man who has a lot of ideas. He summed him up as a person with many solutions to which there are no known problems.

Machine Age in Russia Is Dayton Speaker's Topic

Nevin L. Bean, veteran Ford Motor Co. automation and production engineer, will speak on "The New Soviet Machine Age—A Look at Automation in Russia" at the May 19 meeting of the Dayton chapter. Mr. Bean is technical assistant to the general manager of Ford's Automatic Transmission Div., and is one of the few American engineers who have studied firsthand the Soviet postwar economic developments.

In December, 1955, Mr. Bean was selected as one of three U. S. engineers to tour Russia on an exchange basis to study Russian engineering and manufacturing methods. In April, 1957, he was chosen to represent this country as a technical consultant at an international conference on automation in Paris. He is a registered professional engineer and lives in Dearborn, Mich.

The Dayton meeting, to be held at the Miami Hotel, will be Chapter 18's annual past chairmen and executives' night. The Springfield, Ohio, and Richmond, Ind., chapters of ASTE will be in attendance, and will consider this visit as their regular May meeting.

Williamsport Plans Tool Trade Contest

The executive committee of Williamsport chapter has completed plans for the chapter's second annual tool trade contest, in which awards are presented to outsanding students in toolmaking and tool design at the Williamsport Technical Institute.

A total of eight awards are presented. The first-place award consists of a Tool Engineer's Handbook, a year's membership in Chapter 49, and a certificate of achievement in toolmaking and tool design. Second prize in each trade is a Tool Engineers Handbook and a certificate of achievement.

New Chapter Officers Are Listed

BIRMINGHAM: Walter Krug, chairman; William R. Gillies, first vice chairman; Homer Hooper, second vice chairman; J. E. Wilkinson, secretary; W. E. Webster, treasurer.

CALUMET: R. J. Helton, chairman; E. A. Morgan, first vice chairman; B. W. Clark, second vice chairman; R. H. Boettger, secretary; E. W. Menke, treasurer.

COLUMBUS: Archer B. Jones, chairman; Robert Snider, first vice chairman; Carl Winkleman, second vice chairman; James McKinnney, secretary; Loyd Grossman, treasurer.

DAYTON: Jack Copeland, chairman; Andrew Bailey, first vice chairman; Herb Leach, second vice chairman; William Whyte, secretary; Noel Atherton, treasurer.

GOLDEN GATE: Jim Brennan, chairman; Charles Driesbock, first vice chairman; John E. Wilson, second vice chairman; Cliff Marker, secretary; Newell Partsch, treasurer.

MUNCIE—Newly elected chapter administrators pose for family portrait. From left are: front, N. Francis Wilson, first vice chairman; Lester F. Lotz, chairman; Harry L. Keesaer, second vice chairman. Behind are Vergil Ferratt, secretary; Charles Marker, treasurer; and Emmett Blocher. *—John Scheerer*

SANTA CLARA VALLEY—New officers (left to right) are Carl F. Kaiser, second vice chairman; John Groves, treasurer; William H. Forbes, first vice chairman; Howard W. Holt, chairman; and Rudolph Komuchar, third vice chairman, the chapter's first. Robert W. Brown, not pictured, is new secretary.

GRAND RIVER VALLEY: G. Dilly, chairman; P. Bowman, first vice chairman; A. K. Baird, second vice chairman; W. Karges, third vice chairman; R. Mason, secretary; D. Mead, treasurer.

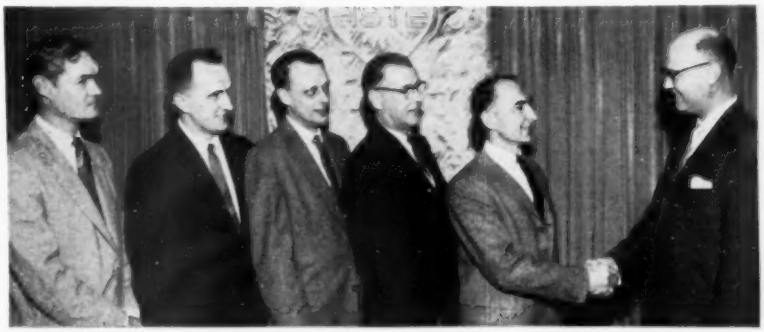
HENDRICK HUDSON: William Edmiston, chairman; Gerald Hamme, first vice chairman; H. R. Bancroft, second vice chairman; Warren Christian, secretary; Harry Osterberg, treasurer.

HAMILTON: Ralph G. Fechnay, chairman; William E. Durrant, first vice chairman; Oreland McIntyre, second vice chairman; Ron Tipping, third vice chairman; Russ Wilson, secretary; Jack Hillier, treasurer.

WESTERN RESERVE: Gene Brown, chairman; Charles W. Ramsey, first vice chairman; Steve Millik, second vice chairman; Eugene Hagman, third vice chairman; Amos Bechtel, secretary; Paul Kechler, Sr., treasurer.

WILLIAMSPORT: Lester E. Zimmerman, chairman; Samuel C. Fry, first vice chairman; Stanley Skowronski, second vice chairman; Robert Foucart, secretary; George R. DeLong, treasurer.

WINDSOR: M. Hollo, chairman; A. Underwood, Jr., first vice chairman; William Maddock, second vice chairman; William Striowski, secretary; George Kovosi, treasurer.



TWIN CITIES—ASTE Vice President William Moreland (right) congratulates the men he has just installed as chapter officers for the coming year. From left are: Arthur Stockwell, secretary; George Minarik, second vice chairman; Gerald Oppel, first vice chairman; Frank Liljemark, treasurer; and Arnold Lidfors, chairman. *—David Johnson*

New Chapter Officers Named

KANSAS CITY: Joseph E. Gardner, chairman; Dan E. Anderson, first vice chairman; Paul W. Arnold, second vice chairman; Lewis F. Alley, secretary; Robert S. Harley, treasurer.

LANSING: Keith Williams, chairman; Harvey Robey, first vice chairman; Payton Beam, second vice chairman; Robert Knowles, secretary; Leonard Sear, treasurer.

MANSFIELD: W. J. Burrer, Jr., chairman; Mel Brooking, first vice chairman; Don Smith, second vice chairman; Fred Loykovich, secretary; William Brendemuhl, treasurer.

NORTHERN MASSACHUSETTS: George A. Stanley, Jr., chairman; Harold Gardner, first vice chairman; John W. Turton, second vice chairman; Raymond F. Clement, secretary; John D. Sinclair, treasurer.

PEORIA: W. Bahnfleth, chairman; H. Austin, first vice chairman; C. Tobin, second vice chairman; O. Simpson, secretary; W. Bristow, treasurer.

PEORIA STUDENT GROUP: Jack B. Slocum, chairman; Kenneth E. Bledsoe, vice chairman; Donald D. Simpson, secretary; Samuel L. Melvin, treasurer.

DETROIT—Standing on a two-foot-high stool to equalize the proceedings, ASTE National Director Charles M. Smillie puts chairman's pin on the lapel of new Chairman Tony Rogers. Other officers installed by Mr. Smillie at the Shamrock Festival March 13 held at Bonnie Brook Country Club were Bernard Wallis, first vice chairman; Bruce Greenwood, second vice chairman; Joseph Wrobel, third vice chairman; Frank McKeen, secretary; and Stanley Commer, treasurer.

ERIE—Newly installed officers are (left to right, seated) Richard A. Banaszek, first vice chairman; Samuel A. Fiorenzo, chairman; (standing) Thomas G. Brown, second vice chairman; James O. Starn, treasurer; and Erwin Finke, secretary. Seated at right is Henry W. Sedler, immediate past chairman. Installing officer was ASTE Director Charles M. Smillie of Detroit. *—Leo B. Weiner*

MID-HUDSON: H. J. DePew, chairman; Nils Larson, first vice chairman; Vincent J. Cavalieri, second vice chairman; Gill Tompkins, secretary; Daniel Sabia, treasurer.

MISSISSIPPI: J. Alexander, chairman; R. Russell, first vice chairman; John Doering, second vice chairman; J. Stefan, secretary; Al Beck, treasurer.

MONADNOCK: Raymond Carter, chairman; Robert Burr, first vice chairman; Earle Quimby, Jr., second vice chairman; Charles King, secretary; David Piper, treasurer.

NEBRASKA: George S. Graves, chairman; Harley Bair, first vice chairman; James R. Mercer, second vice chairman; Herbert K. Bro, treasurer; Lee Utiger, secretary.

SPRINGFIELD, Ohio: William H. Anderson, chairman; J. Norman Dye, first vice chairman; Russell S. Snook, second vice chairman; John J. Schafer, secretary; Joseph Rinehart, Jr., treasurer.

RIVERSIDE: Phil Christofferson, chairman; Glen Porter, first vice chairman; James Diamond, second vice chairman; Robert Hoge, third vice chairman; Eric Chick, secretary; Richard Baker, treasurer.

ROCKFORD: Marshall Samuelson, chairman; Ernest Norrman, first vice chairman; Walter Lewis, second vice chairman; Leslie Monson, third vice chairman; Lester Teachout, secretary; Larry Geiger, treasurer.

MERRIMACK VALLEY—John X. Ryneska (left), national treasurer, installed the following officers at special meeting in Lowell, Mass.: Arthur Clement, chairman; Leighton Reynolds, first vice chairman; Leon Rice, Jr., second vice chairman; Alsdon Arold, secretary; and James Handley, treasurer. Seated is James Low of the National Association of Manufacturers, speaker of the evening. *—Dante J. Patti*

Springfield, Ohio

At the regular monthly meeting at the Elks Clubhouse, Mar. 11, H. E. Swayze, assistant manager of the Wrought Products Sales in the magnesium department of Dow Chemical Co., addressed 50 members. His topic was "Light Metals for Jigs and Fixtures" and was augmented by illustrations. Mr. Swayze, who has played an important role in the development and new uses and the marketing of magnesium metal, has been with Dow since 1937 and was the recipient of the Willard H. Dow award for outstanding research in the field of magnesium.

Lansing

At the Civic Center, Rooms A, B and C, on Mar. 10, 70 members were assembled to hear Herman Rittger, field engineer for Marshall Steel Co., speak on "Heat Treating of Tool Steels." He talked of water, oil and air-hardened tool steels and their advantages, which included analysis, internal soundness, and personality and its effect on the utility of the steel. He also mentioned the aging of steel by heating and cooling.

Dayton

Dayton Chapter has just reported the successful completion of a four-session seminar on hydraulic power held during February and March. The program drew 378 total registrants. There were 69 area industries represented, and 15 surrounding towns, including one from out of state. Average attendance at all four sessions was 83.1 percent.

Tulsa

Dale Davis, plant engineer with Oklahoma Steel Casting Co., was the speaker at the Mar. 11 dinner meeting in the French Room of Borden's Cafeteria. There were several awards to engineers, a service award pin to Jack Luey for work on bulletins, and tool handbook to Adolph Hugo and most new members.

Rockford

Professor Paul J. Grogan, chairman, department of engineering, University Extension Div., University of Wisconsin, spoke to 71 members Mar. 13 at the LaFayette Hotel. Professor Grogan, who has published some 25 to 30 technical papers and written several sections of a nationally distributed encyclopedia, spoke on "Gears between the Ears," after which new officers were installed by Ed Dickett, the chapter's first chairman.

Keystone

The Chamber of Commerce Building in Scranton, Pa. was the scene of a panel discussion on Mar. 17. "Promoting Interest and Building Up Membership" was the theme, the panel consisting of: Jack Lipman, mechanical engineer at Daystrom Instrument, chairman; Orland Sayre, sales engineer for The Bellows Corp.; Jack O'Leary, sales engineer for Ingersoll Rand; Leroy Jensen, chief engineer for Sprague and Henwood; John Sommers, chief purchasing agent for the Maxson Corp.; and Joseph Rappenclueck, R. & D. engineer, Daystrom Instrument.

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San Francisco

"Management's Outlook toward Quality Control" was the subject of a speech given by Robert L. Pappas, manager of Quality Control Div., Ampex Corp., at the Mar. 20 meeting. Mr. Pappas' talk centered around management's obligations and responsibilities in control of quality, and the terms quality and quality control were defined as they exist today. The various ways in which management can contribute to the control of quality were described.

Monadnock

Mar. 20 was the date of the installation meeting at Keene, N. H., when 52 members listened to M. Eugene Merchant, director of physical research. The Cincinnati Milling Machine Co., speak on "Productive Research in Metal-Cutting." Mr. Merchant pointed out that the major aim of research is to reduce machine cost, the most important factor in tool life. The first step is to analyze the present machining processes, using basic scientific and engineering methods, such as microphotography, radioactive tracers, metallurgical analysis, high-speed photography and mathematical investigation with analog computers. Next step is to apply the knowledge gained in the design of new tools and machines, followed by laboratory checking of the results and further requirements. Ceramic tools and spiral pointed drills are typical examples of this process.

Western Reserve

At the technical meeting and installation of officers held Mar. 25 at 422 Cafe, Warren, Ohio, 40 members heard William D. Baker, regional manager of Devcon Corp., speak on "Basic Uses of Plastic Casting Resins in Everyday Tooling," showing by means of a 20-minute slide program, the basic principles involved in preparation and application of these resins to the everyday requirements of tooling.

Cincinnati

Sixty-five members assembled at Engineering Society Headquarters Mar. 11, where they heard William G. Schmidt, sales engineer for Gisholt Machine Co., talk on "Static and Dynamic Balancing." Accompanying his talk was a movie, "The Nature of Balancing," which covered the fundamentals of balancing problems.

Preceding the technical part of the meeting, a movie, "Vacationing in Bermuda," was shown, and new officers were installed for the coming year.

SPECIAL EVENTS

ASTE Tool Show and 26th Annual Meeting, Philadelphia.
May 1-8. Tool Show at Philadelphia Convention Center.

ASTE West Coast Tool Show.
Sept. 29-Oct. 3, Los Angeles Shrine Exposition Hall.

Connecticut Tool Engineers Day.
May 22, New Haven.

Automation Seminar, Penn State.
June 9-13. Penn State University, College Park, Pa.

Connecticut Chapters Plan Tool Engineers Day

In a proclamation by Connecticut Governor Abraham Ribicoff, May 22, 1958 has been officially declared Tool Engineers Day in that state. The Connecticut chapters of New Haven, Fairfield and Hartford, plus the new Central Connecticut group chartered last month, will celebrate the tenth such annual event with a full day's program of plant tours, technical session, and banquet, featuring talks by top industry representatives.

Yale University's Josiah Willard Gibbs Laboratories, modern nuclear research plant, heads the list of tours in the New Haven area. Others include Wallingford Steel Corp., Wallingford; Farrel Birmingham Corp., Ansonia; Geometric-Horton Div., United Greenfield Corp., New Haven; and Greist Mfg., Inc.

"Precision Broaching for Production and Profit" is the topic of both the film and the panel discussion to be presented by three representatives of the Lapointe Machine Tool Co.: ASTE Past President Joseph P. Crosby, now president and director at Lapointe; George C. Bennett, plant superintendent, who was 1957-58 chairman of ASTE's public relations committee; and K. N. Macomber, chief service engineer of the Hudson, Mass., company.

T. A. Boyd, GM research staff consultant, will talk about the "Prophet of Progress," famed GM figure Charles Franklin Kettering, of whom Dr. Boyd wrote in his recently published biography titled *Professional Amateur*. His long personal association with "Boss Ket" yields a firsthand view of the bold thinking and doing, and the wise and witty sayings of that engineer, inventor, man of science.

Fred Dawless, prominent in ASTE and New Haven civic affairs, will act as toastmaster.

ST. LOUIS—Among those present at a special meeting of the chapter's technical publications committee, held to initiate collection of material for the Handbook of Process Planning and Estimating, were (left to right) W. J. Potthoff, vice chairman of the national committee; Francis Sehn, national chairman; Vince Bene, Chapter 17 chairman; and Frank Wilson, national technical director.

CHAPTER MEETINGS

PLACE	May	SPEAKER	SUBJECT
Buffalo-Niagara Frontier. Buffalo Trap & Field Club. 6:30 pm	15	**Harry Conn** Scully-Jones & Co.	Production Tooling Problems
Calumet Area. Phil Smidt Restaurant, Whiting. 6:30 pm	26	Not announced	Broaching
Chautauqua-Warren. First Methodist Church, Lakewood, N.Y.	15	**Merrill Ridgeway** Minster Machine Tool Co.	Progressive Die Design Advantages as Applied to Presses
Cincinnati. Marie Antoinette Ballroom, Hotel Alms. 6:30 pm	2	**Ralph E. Cross**	Business Man's Experience in Washington
Dayton. Miami Hotel. 6:30 and 8 pm	19	**Nevin L. Bean** Ford Motor Co.	New Soviet Machine Age—a Look at Automation in Russia. Joint meeting with Springfield and Richmond chapters.
Denver. American Legion Post #1. 8 pm	14	**Donald E. Oberg** Oberg Mfg. Co.	Carbide Dies
Des Moines. Des Moines Golf & Country Club. 7 pm	15	**Walter Collison** Brehm Die Div., Vulcan Tool Co.	Trimming and Notching Drawn Shells in One Press Stroke
Erie. Polish Falcons Club. 7 pm	6	Vice President Universal Match Co.	Transfer Mechanism
Grand River Valley. Leisure Lodge, Preston, Ont. 6:30 pm	9		Ladies Night
Greater Lancaster. Conestoga Country Club, Lancaster. 7	13	**Joseph I. Karash** Reliance Electric	A Method of Reasoning for Tool Design
Hamilton District. Brant Hotel. 6:30 pm	9	**Harry Conn** Scully-Jones & Co.	Production Tooling Problems
Indianapolis. Antlers Hotel. 6:30 pm	1	**Duane Carter** U. S. Auto Club	New Developments in Race Car Design
Kalamazoo. Western Michigan University Center.	26	**Dr. Schoendeust Goetz** of Luxembourg	Membership award dinner
Kansas City. Elks Club Lodge. 7 pm	21	**Harry Conn** Scully-Jones & Co.	Economics of Tooling and Manufacturing
Lehigh Valley. Hotel Traylor. 8 pm	16	**Prof. George Kane** Lehigh University	Economic Tool Cutting
Long Island. Garden City Hotel. 8:30 pm	12	**George H. Kendall** Kenhos Corp.	Sequence Machining and Automatic Assembly
Los Angeles. Rancho Golf Course. 10:30 am	22		Golf Tournament
Louisville. YMCA, 3rd & Central. 6:30 pm	13	**Robert Koebel** Koebel Diamond Tool Co.	Latest Developments In Cemented Diamonds
Mansfield. Mt. Vernon. 7 pm	15	**John C. Wilson** Thompson Grinder	Grinding for Profit in the Toolroom
Merrimack Valley. Locusta Room, Manchester, N.H. 6:45 pm	1	**Charles LaBardie** Devcon Corp.	Tooling with Plastics
Mid-Hudson. The Mirabel, South Rd., Poughkeepsie. 7:30 pm	13	**Neale E. Howard** Millbrook Boys School	Satellites and the Moonwatch Program
Milwaukee. American Serb Memorial Hall. 6:30 pm	9	**William Stark** Patent attorney **Al Bishop** Continental Sound Engineering Co.	Patents Closed circuit TV demonstration
Mississippi. King Edwards Hotel. 7:30 pm	5	**A. B. Williamson** McGill Mfg. Co.	Technique of Manufacturing Domestic and Foreign Ball Bearings

Tool Steel Failures Explained at Hamilton

At least 95 percent of tool failures are attributable to factors other than the quality of the steel, 94 members of the Hamilton chapter were told at their Mar. 14 meeting in the Fischer Hotel.

Bruce M. Hamilton, chief metallurgical engineer of Atlas Steels, Ltd., Welland, Ont., outlined five factors that should be considered if tools are to give maximum service. They are (1) the selection of the type of steel most suitable for the particular application; (2) proper heat-treatment; (3) proper grinding; (4) good tool design; and (5) an assessment of the mechanical and operating conditions in the part. By means of slides, Mr. Hamilton illustrated some of the results which occur when any of these factors is ignored.

Obituaries

Rockwell B. Ward, Hartford, vice president of Parsons Diamond Products.

James Balton, Baltimore, partner, Toolcraft Co.

Bernard Beaman, Dayton, chief engineer for United Hydraulic, Inc.

Robert R. Brechlin, Fond du Lac, tool superintendent and engineer at Valley Iron Works.

Leroy Cobb, Kalamazoo, owner of Leroy Cobb Co.

August H. Douglas, New Orleans, Vice president of O. H. Van Horn.

Harvey T. McCarthy, Worcester, sales engineer with Lapointe Machine Tool Co.

Walter Morse, Hartford, executive vice president for Stanley Works.

Louis W. Scherf, Detroit, estimator, Dawson Carbide Industry.

Fred Jessop, Paterson, chief manufacturing engineer, Reaction Motors.

Max Genser, Little Rhody, president, Genser Mfg. Co.

Melvin H. O'Dell, Saginaw Valley, toolroom supervisor, Lufkin Rule Co.

Charles R. Parker, Peoria, superintendent of planning, Caterpillar Tractor.

James Robinson, Detroit, chief engineer for Vickers, Inc.

Robert G. Smith, Northern New Jersey, partner, R. G. Smith Tool & Mfg. Co.

George T. Tyson, Northern New Jersey, buyer, manager of sales, Gables.

CHAPTER MEETINGS

PLACE	May	SPEAKER	SUBJECT
Monadnock. Kingsbury Machine Tool. Cafeteria. 7:15 pm	22		Plant Tour
Montreal. Canadian Legion Hall. 7:45 pm	21	Bruce M. Hamilton Atlas Steel, Ltd.	Tool Steel Failure, Causes and Remedy
New Haven. New Haven, Conn. All day	22		Annual Connecticut Day. Joint meeting of New Haven, Hartford, Fairfield chapters
North Shore. Hotel Edison. 6:30 pm	13	Not announced	Quality Control
Northern Massachusetts. Eagles Hall, Gardner, Mass. 8 pm	20	Harvey S. Parry Shell Chemical	Epoxy Resins
Northern New Jersey. Essex House Hotel. 8 pm	13	W. S. Holloway Madison Industries.	Modern Gun Drilling
Northwestern Pennsylvania. Emporium Moose Club. 6:30 pm	5	Allen D. Gunderson George Gorton Machine Co.	Tracer Controls in Action
Peoria. Bradley University Student Union Center. 6:30 pm	13	Dr. Cylvia A. Sarkin	Your Personality Is Showing
Phoenix. Desert Hills Hotel. 7 pm	12	Ben Beveridge Pioneer Aluminum	Aluminum Tooling Plate
Piedmont (North). Greensboro, N.C. 6:30 pm	12	W. S. Wagner E. W. Bliss Co.	Metalworking Principles Underlying Punch and Die Design
Piedmont (South). Charlotte, N.C.	13	W. S. Wagner E. W. Bliss Co.	Metalworking Principles Underlying Punch and Die Design
Portland, Me. Falmouth Hotel. 2:30 and 7 pm	2	Robert Timberlake Laughlin Div. of American Hoist & Derrick	Drop Forging Practices
Portland, Ore. Burns Restaurant. 8 pm	15	Glen H. Stimson Greenfield Tap & Die	Gages—Watchdogs or Bandits
Riverside. Mike's Cafe. 7 pm	13	Glen H. Stimson Greenfield Tap & Die	Gages—Watchdogs or Bandits
Rockford. Lafayette Hotel. 6:30 pm	8		Student drawing contest awards will be presented
Saginaw Valley. High Life Inn, Saginaw. 7 pm	15	James Leland Parker Rust Proof	Cold Extrusion
San Fernando Valley. Hody's Restaurant. 8 pm	2	William K. Lear Rosan, Inc.	Rosan Products, as Applied to Tooling
San Francisco. Rickey's Red Chimney. 7 pm	22	Glenn H. Stimson Greenfield Tap & Die	Gages—Watchdogs or Bandits
Santa Clara Valley. Sabella's 7:30 pm	15	Frank Lamphear Chas. Brunning Co.	Optics and Optical Tooling
St. Louis. Ruggeri's Restaurant. 6:30 pm	1	Allen S. Black Fellows Gear Shaper Co.	Manufacturing of Gears
Syracuse. Seneca Falls Country Club. 2 pm	13	Arthur Beerse	Plant tour, Goulds Pump, Inc.
Tri-Cities. Rock Island Arsenal. 6:30 pm	14	Joseph Psenka National Broach	Modern Methods of Broaching
Tulsa. Borden's Cafeteria. 6:30 pm	13	Cranbrook Marshall Douglas Aircraft	Demonstration of actual tooling

Positions Wanted

EXTENSIVE EXPERIENCE INCLUDES die design, stamping processing, plant layout and management of stamping sales. Excellent automotive contacts. Seeking sales position Detroit area. Write to: Box 114, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

B.S.I.E. Age 36. Ten years' experience. Well-rounded background all phases manufacturing, including: processing, cost, estimating, quality control, plant layout, methods, tool and product design. Two years' supervision in manufacturing engineering. Ability to handle and get along well with people. Desire responsible position with opportunity for growth. Detroit area preferred. Write to: Box 116, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

MACHINE TOOL SALESMEN wanted. County-wide opportunity to represent leading machinery firm in sale of extensive line of new equipment and/or used. Only apply if you have top sales record. Send all details first letter. Correspondence confidential. Write: L. D. Srybnik, S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y.

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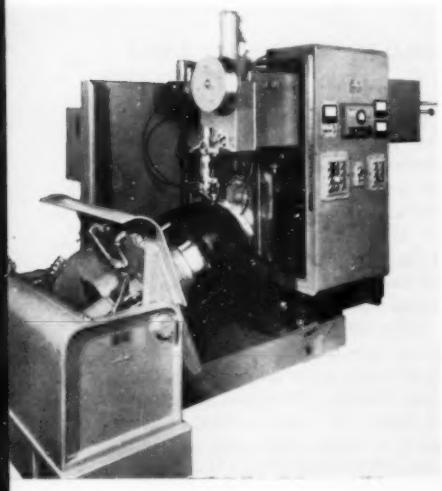
PROGRESS IN PRODUCTION

FABRICATE JET PARTS WITH AUTOMATIC WELDER

High-temperature jet engine and missile components requiring precision tolerances are being fabricated by this inert gas welding machine designed and built for an aircraft manufacturer by Anchor Machine & Tool Co. of Jackson, Mich. Except for loading and unloading, the machine is automatic and performs a complete welding cycle with preset operations.

An unusual aspect of the machine is the electrical interlock controls which, when in automatic position, make all push buttons inoperative except cycle start and emergency stop. The machine also can be preset to perform two separate welds at different points on the same part. An adjustable welding overlap includes independent shutoff of wire feed and welding current for crater fill.



'MODERN' TOOLS THROUGH CONVERSION

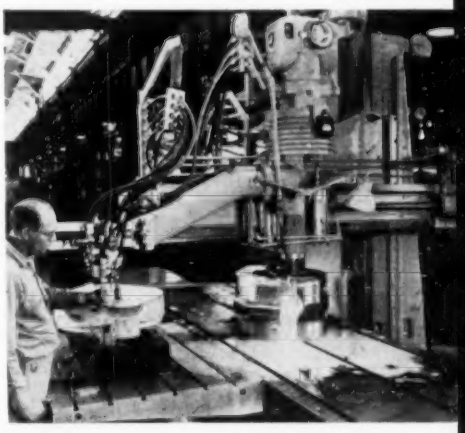
Practicality of converting outmoded machinery into modern, economical production tools is dramatically demonstrated by a now up-to-date three-dimensional tracer-controlled milling machine at the Torrance, Calif. plant of The National Supply Co. Underneath the versatile, "modern" miller is an old open-sided 48-inch by 48-inch by 16-foot planer.

Engineers of National designed the new machine, and construction was done by the plant's maintenance department. First step was to modify the planer so that all machine movements were hydraulically operated. A T-slotted plate was then made to serve as a template or master-form mounting base. This was attached to the outboard side of the table and may be positioned at any point along its 16-foot length.

Basic to conversion was the integration of a hydraulic milling spindle supplied by Romulus Tool and Engineering Co. In this installation a 25-hp, adjustable-speed spindle was used to replace the planer toolmount. Using two geared speed ranges, the spindle provides constant horsepower at speeds from 60 to 3000 rpm. Two small hydraulic cylinders, mounted on opposite sides of the spindle housing, control the 8-inch vertical travel of the milling head. For certain applications, the milling head is easily swiveled 45 deg each side of vertical. Feed rates for all movements range from 0 to 25 ipm.

The workpiece is mounted on the machine table which is moved hydraulically from a tracer valve mounted on a sleeve extending from the spindle. Any deflection of the tracer stylus causes responsive action in machine movement. A pendant control is used to start and stop the spindle and also for rapid traverse of the machine table.

Power, for both machine movements and spindle rotation, is from a 30-hp combination hydraulic power unit—using a 20 gpm variable-delivery pump to the spindle and dual pump of 11-gpm capacity for table rapid traverse and three directional feed movements. Cross and vertical rapid transverse are accomplished by opening the tracer control valve for maximum feed.



The apparently "new" tracer-controlled milling machine at the Torrence, Calif., plant of The National Supply Co., is actually a converted open-side planer. An hydraulically powered 25-hp milling spindle from Romulus Tool and Engineering Co. replaced the planer tool-mount. Spindle speeds are adjustable from 60 to 3000 rpm—all at constant horsepower.

Offers Many Big Advantages

- ONE-HALF THE WEIGHT
- TRI-METAL CONSTRUCTION — Aluminum — Cast Iron — Steel
- 6-SIDE UTILITY — Can Use Head-Type Bushings, on Sides, Top, Bottom
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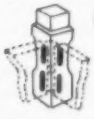
Bushings can be used on all 6 sides. A unique interlocking feature is the aluminum through the cast iron legs, which assures strength and stability. Walls can easily be machined without distorting the Jig. 47 Sizes available 1" x 1" x 1" to 4" x 8" x 4". *Full size Tracing Templates are available for all 47 sizes.*



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Aluminum goes all the way through the cored slots in the cast iron legs — forms a unified, interlocking joint — assuring light weight, but rugged strength.

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ECONOMIC METAL FORMING WITH PLASTIC METAL ALLOY

Medium production-run metal forming has been attained with plastic tooling as result of a recently developed plastic-metal composition. Based upon an epoxy resin system reinforced with metal or glass fibers and metal fiber flocking, the new tooling method permits runs up to 150,000 stampings where low gage softer metals are to be formed. The technique also is applicable to prototype and development type metal forming dies, secondary operation dies, hydroform and rubber pad forming dies, stretch dies and fixtures.

This material and process innovation, developed by Bakelite Co. Div. of Union Carbide Corp., is known as Epoxy-Alloy. Reduced tooling time and cost economies are inherent in the technique. Among its advantages are that it permits mass casting of the tools and dies, it has substantially increased thermal conductivity, and provides greater modulus and impact strength.

To date, approximately seventy Epoxy-Alloy dies have been put into commercial operation. Over 130,000 stampings of a 0.025-inch thick brass automotive radiator cover have been made from one such die. Another has formed more than 65,000 units from 0.035-inch thick steel for a refrigerator section. This die was delivered in five weeks. Thirty-five Epoxy-Alloy dies for a military project were built in 15 weeks at a cost of $250,000.

After producing 130,000 units for 0.025-inch thick brass, the full year's requirement for one auto model, parts were still passing quality inspections.

Plastic tools fabricated from the material consist of an epoxy resin system reinforced with metal or glass fibers. The surface is composed of an epoxy resin system reinforced with chopped metal fiber flocking. The entire tool is pressure-cast and cured simultaneously.

An extensive three-year research and development program, carried out by Bakelite Co. in cooperation with tool and die fabricators, preceded the announcement of the Epoxy-Alloy process. These investigations have shown that draw dies of Epoxy-Alloy can be used (1) for runs of 50,000 to 150,000 or more stampings of the thinner more easily formed metals; (2) for runs of 10,000 to 50,000 stampings in which Epoxy-Alloy contoured punches and pads are used with metal inserts, draw rings, and blank holders; (3) for runs of 1000 to 10,000 stampings without the use of metal rings or inserts; and (4) for prototype or development runs encountering deep draws of heavy metal or large compound-contour stampings up to one-quarter inch thick steel.

More than 65,000 parts have been produced on these dies using 0.035-inch steel sheet.

COLD EXTRUSION ADVANCE FOR AIRCRAFT MAKERS

Economic production of hollow aircraft parts is probably nearer with the successful cold extrusion of hollow titanium shapes by Battelle Memorial Institute. The accomplishment climaxed two years of studies for the Air Force by the research laboratory's light metals staff under the direction of Paul D. Frost and Alvin M. Sabroff.

Although production size equipment seems foreign to research laboratories, a 700-ton, three-story-high hydraulic press was the important tool used in the study. In cold working titanium, hollow shapes were produced by forward and backward extrusion. One-and-

one-half-inch diameter slugs of unalloyed titanium were backward cold extruded from the giant press to make cups up to three inches long with wall thickness down to 0.22 inch. This represents 50 percent reduction.

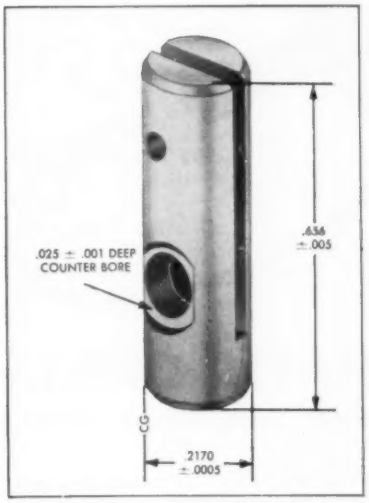
Cup-shaped billets with 1½-inch outside diameters and ⅞-inch inside diameters were forward extruded into cylinders with wall thicknesses down to 0.15 inch.

Resultant surface finishes were equivalent to a smooth turned finish—30 to 60 microinches. In addition, mechanical properties of the unalloyed titanium are improved. Tensile strength, for example, has been increased as much as 30 percent.

UNUSUAL TOOL USE BEATS PRECISION PROBLEM

Ingenious use of a torque wrench helped solve a tricky counterboring problem. The job involved manufacture of small irregular parts which presented difficulty in holding the 0.025 deep counterbore to a tolerance of ±0.001 inch. This was a production application performed on a light drill press.

Correction of the problem came with discovery that a Sturtevant sensory signal torque wrench could be used in place of the regular drill press handle. This enabled the operator to control to exact limits the force applied on the spindle of the drill press during counterboring. By presetting the signaling type torque wrench the operator did not need to view the direct reading scale on the torque wrench and could concentrate on the small part as they normally would do. Through a trial and error, it was discovered that the torque wrench reading should be 90 in-lb to assure constant duplication in counterboring the small part.



Close-up view of finished piece which had posed the counterboring problem.

Torque wrench attachment on drill press enables operator to easily counterbore to close tolerances.

Momentary release feature of the wrench automatically controlled the forces applied by the operator as they progressed with the counterboring application. Using a torque wrench actually made it easier and faster for the operator to perform this operation and rejected parts were minimized.

ROLLED CLAD PLATE ALLOYS FORECASTS ECONOMIES

Successful rolling in clad plate form of highly corrosion-resistant alloys has been accomplished by Lukens Steel Co. Research has centered on four cladding materials—Hastelloy B, Hastelloy F, Hastelloy C and titanium. In clad form, these materials are expected to afford considerable cost savings in various applications in chemical, petroleum and petrochemical industries where corrosion is a major problem.

Development has now reached a point where Lukens is considering inquiries about the materials on an experimental-order basis.

The cladding process, originally pioneered by Lukens in 1930, uses heat and pressure to make a permanent, integral bond between a layer of materials as nickel, Monel, Inconel, stainless (and now with the Hastelloys and titanium) and a thicker layer of a relatively inexpensive backing material.

The Hastelloys, developed by Haynes Stellite Co., are ferroalloys using relatively large amounts of nickel and chromium plus other alloying elements to achieve corrosion-resistant properties.

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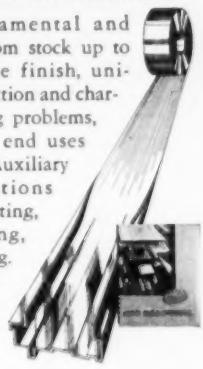

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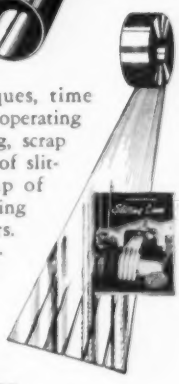
Operating techniques, time studies, analyses of operating cycles, coil handling, scrap disposal, selection of slitters and setting up of slitting lines, including coilers and recoilers. Advantages of slitting and how to compute "profit-point". 76 pages, fully illustrated.



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TOOLS of today

Forming Machines

Designed to blank and form, automatically, a variety of packaging components from coil plastic, the EM-134 forming machine can form articles with dimensions up to 9 x 11 in. or circular parts to 9-in. diameter with a depth of draw to 3 in.

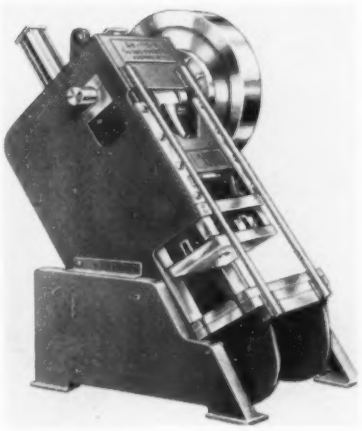
The machine is furnished complete with double roll feeds, scrap cutter, stock reel, electronic control cabinet and air pressure regulating and control equipment.

Production ranges between 15 to 25 pieces per minute, depending on the size and complexity of the article to be formed.

A second unit, illustrated, is a 110-ton box slide press, built to JIC standards which incorporates a self-cooling combination brake and clutch of the diaphragm type. Friction surfaces of both brake and clutch are of sintered metal, and both linings can be replaced without removing the wheel.

The box type slide has ways in the body 35 in. long. Pivot point of the pitman connection is near the bottom of the slide.

The power slide adjustment mechanism incorporates a sleeve which carries the ball socket and cap, a gear, and a buttress threaded section. A lock



prevents change in adjustment during operation. Hand adjustment is standard.

An inclining mechanism can be operated either manually or by air power. Design of the press permits the balance wheel, back shaft and motor drive, except for the pinion and its outboard bearing, to be enclosed within the body on a geared press.

Emhart Mfg. Co., V & O Press Div., Hudson, N. Y. **T-5-1**

Submerged Arc Welding Machine

A mechanized welding machine called Lincolnweld ML-3, provides automatic wire feed, flux flow and travel speed, but permits manual guiding of the welding arc for the submerged arc welding process. The unit feeds a continuous wire electrode from a coil to a compact hand-held gun which is held against the joint and is propelled at a preset speed by a small motor. A low pressure air system flows flux from a large tank to the gun from which it drops to completely cover the arc at all times, yet does not flow ahead of the arc.

Preset speeds up to 70 ipm using up to 600 amps are possible with this manual, mechanized unit. It can be used on materials ranging in thickness from 10 ga up.

The machine provides mechanization and control of all welding variables except guiding, which is done manually. Compact design of the welding gun makes it highly maneuverable, permitting the operator to readily follow contours, shapes or weld any type of downhand joint. With automatic travel speed, operators can weld consistently to the specified bead size, speed and weld quality.

Mechanized travel speed is supplied by a small d-c motor mounted on the

nozzle end of the welding gun.

The unit operates from any variable voltage, motor-generator set or rectifier with capacity to supply 400-600 amp d-c. A separate 115 volt a-c source is required for the control circuits. Arc striking employs the "hot-start" method in which full welding power is on the electrode as it touches the work to

---

Correction: In the "Tooling for Competition" article in the April issue of THE TOOL ENGINEER, a paragraph concerning The Carpenter Steel Co. referred to "the 12 Vega steels." This should have read "Specifications and characteristics of each of these 12 matched set tool steels dovetail so closely that the user can anticipate the results when changing from one to the other." Vega is one of the 12 steels.

establish the arc. Except when welding, the electrode is "cold," or without welding power, to prevent accidental arcing between electrode and ground.

The Lincoln Electric Co., Cleveland 17, Ohio. **T-5-2**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Work Position Locator

Model XA-515 Ex-Ac provides fast, accurate means of locating or measuring work position and dimension on any jig borer or jig grinder, or other machine tools with rotating spindles.

The equipment is capable of measuring accurately to a few millionths of an inch; locating accuracy on a jig borer is limited only by the table lead screw and machine spindle accuracy.

It consists of an electronic frictionless indicator gage head, slip ring and amplifier with meter. The indicator gage head and slip ring is attached to the jig borer spindle and may be rotated manually or under power at speeds up to 100 rpm. The slip ring eliminates wind-up of the gage head leads around the spindle. The Ex-Ac meter may be located at any convenient viewing location nearby or on the machine.

It converts any jig borer into a universal measuring machine capable of: Locating and aligning work on the table; measuring taper bellmouth, lean, roundness concentricity of holes, bosses, or plugs; measuring squareness; measurement of center to center distances; screw lead checker; determining spindle run-out; and blending contours.

The Protector gage tip protects the gage head mechanism from accidental flows in handling or setup. The three-scale amplifier provides magnification up to 10,000 x ±0.005 in. The Ex-Ac can be used on inside and outside diameters from 1/16 to 10 in.

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio. **T-5-3**

Deburring Tool

The BurrAway tool offers a method of removing burrs, fins and other hole irregularities.

The tool, which can be used by an unskilled operator, can remove burrs on both the top and bottom of a hole from one side.

A cutter blade is retained in a slot in the body of the tool, and a spring-loaded plunger holds the cutter blade in the open ready-to-cut position. Front or rear angle of the cutter blade will not function until it contacts either the top or bottom edge of a hole. This feature makes this tool useful where irregular thickness and positioning of the part is concerned.

When the feed-cutting load exceeds preset spring pressure, the blade continues to collapse under feed until it stops cutting. Because edges on the top

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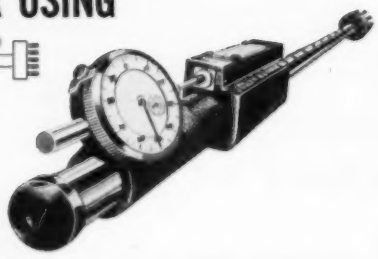

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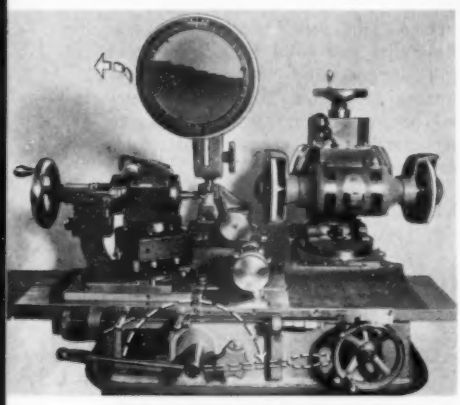
of the cutter blade are rounded, there is no serious injury to the finished hole surfaces. Cutting action of the blade leaves no burrs in the hole to interfere with assembly of component parts.

Cogsdill Tool Products, Inc., 12980 W. 8 Mile Rd., Oak Park, Mich.

T-5-4

Optical Comparator for Form Relieving Tool

The optical comparator attachment mounted on a bracket attached to the universal form relieving fixture and grinder swings from an out-of-the-way position, bringing the lens over the work. From this position it projects the ground profile, with 20 to 1 magnification, on an 8-in. diameter ground glass. This permits checking progress of the grind and accurate comparison with the enlarged template drawn on



the glass. The attachment in no way interferes with setup or operation of the equipment. Optical checking and return of the work to grinding can be done in a few seconds since the tool remains in the chuck and setup of the fixture is undisturbed.

Royal Oak Tool & Machine Co., 29800 Stephenson Hwy., Royal Oak, Mich.

T-5-5

Automatic Screw-Feeder

A building-block component for high-speed, automated production line automatically feeds, inserts and tightens socket set screws ranging in diameter from No. 6 up to ⅜ in., in lengths up to ¾ in.

Setomatic, can make up to 2500 complete installations an hour in as many different product assemblies.

Because of its mechanical design and electronic control system the Setomatic

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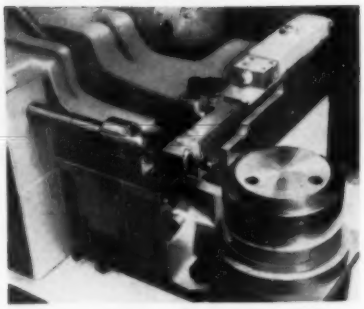

is suitable either as an attachment to a single machine or as an integral part in a continuous, even completely automated production line.

The device will install setscrews with any type point (including the SPS knurled cup point) at full recommended tightening torque.

The equipment consists of two basic units: the screw-supply system picks up screws from a supply hopper, orients them and feeds them into a driver-feed tube; the drive mechanism picks up the screws from the feed tube, inserts them into tapped holes and tightens them to a preset, closely controlled torque.

Loose set screws in the vibrating hopper machine are fed via a spiral track to a selector that passes properly oriented parts and pushes back those pointing the wrong way.

Screws are fed by air pressure through a tube to the driving unit. When the tube is filled, the feeder unit stops automatically and resumes when the supply of screws in the tube drops below a predetermined level.

The Setomatic will install screws vertically, horizontally or at any angle. Two machines can be mounted as close as ninety degrees to each other to permit two screws to be installed simultaneously with a single control.

If a poorly tapped hole is encountered, a slip clutch on the drive spindle stops the driver from rotating and a cam returns the driver to its start position.

Standard Pressed Steel Co., Jenkintown, Pa. **T-5-6**

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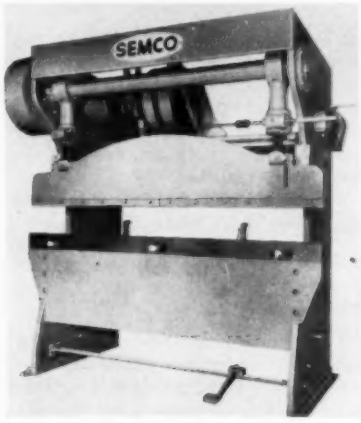
Wear Plates

Designed for use wherever there is sliding contact between flat metal parts, these wear plates are made of steel and electroplated with a bronze bearing surface. This provides the ready machinability and solid backing of steel with long-wearing, nonseizing, free-running properties. The bearing material becomes an integral part of the steel itself, and it cannot displace under heavy loads.

Lamina Dies & Tools, Inc., Royal Oak, Mich. **T-5-7**

Press Brakes

Entire frame weldments of Model 635 and Model 835 power press brakes include solid one-piece lower beds, machined after fabrication. The weldment incorporates ½ x ⅞ slot in lower bed in exact alignment with ram, allowing setting of large dies when press is used with die holder removed. Foot tread pedal is adjustable to any position with



This blade could have been packaged and shipped as a genuine MARVEL High-Speed-Edge Blade . . . and it might have performed to a customer's satisfaction. Instead, it was rejected and will be scrapped because inspection revealed a minute imperfection.

There's nothing unusual about this. Certainly, other hack saw blade manufacturers inspect their products, and undoubtedly reject blades for one reason or other, because they are trying to market the best blades they know how to make.

And that's the point—here at MARVEL, where the composite blade was invented and perfected over 30 years ago, we believe we know more about making high-speed-edge hack saw blades than any other maker. We've been at it longer, and the unequalled performance of MARVEL Blades on every kind of material is evidence that we're right.

Use MARVEL Blades on your power hack saws with perfect confidence that they have no equal. You can get MARVEL Blades at your nearby Industrial Distributor.

Write for the new MARVEL Cutting Tool Bulletin.

PB-122

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MARVEL Metal Cutting SAWS
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uniform action at any point of bed.

Model 635 has 72-in. bending capacity, 12 gage, while Model 835 offers 96-in. bending capacity, 14 gage. In both cases stroke is 2 in. and adjustment, 4½ in. The 3-hp., 1750-rpm motor provides 44 strokes per minute, or adjustable speed drive for 16 to 40 strokes per minute. Over-all shut height with die holder removed is 12½ in.; over-all shut height with the die holder is 8 in. Depth of throat from center line of bed and ram is 6½ in. Distance between housings is 61 in.

Service Machine Co., 210 Miller St., Elizabeth, N. J. **T-5-8**

Vise

Model 77 self-centering air-hydraulic vise is a heavy-duty unit with 7-in. jaws. The vise centers and holds parts varying in size or shape when the work requires the location of a center or other predetermined point. Vise jaws have a maximum travel of ⅞ in. for each jaw. Vise jaws are infinitely adjustable up to a 7-in. max opening. Holding power on the work is 4000 at 100 psi of air.

It is operated by a foot treadle which keeps vise jaws open or closed without constant foot pressure.

Heinrich Tools, Inc., Racine, Wis. **T-5-9**

Boring and Turning Mill

Designed to provide high capacity, ease and safety of operation, and ease of maintenance, Morando Model VK20 vertical boring and turning mill permits many combinations of heads, tables and attachments.

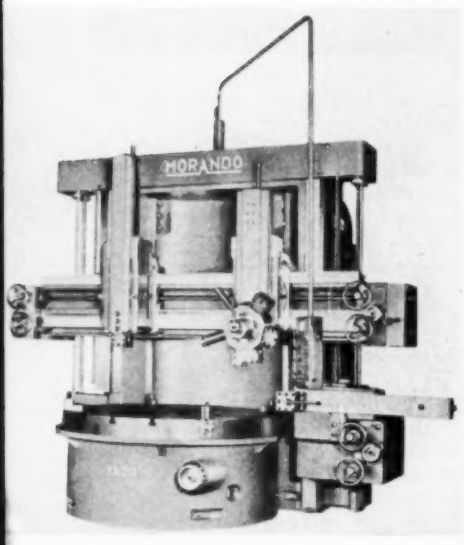
A hydraulically controlled gear-change unit provides 16 spindle speeds in three ranges. Tables are supplied with four-jaw chuck having independent jaws embedded and inserted, with flat-surface chuck having four pairs of parallel T-slots to accommodate clamps, or with three-jaw compound dual-control chuck that can be independent or self-centering.

Controls are simplified and grouped on a separate pendant control panel. Safety devices prevent machine damage due to operators' errors.

Automatic stops with micrometric adjustment can be provided on both vertical or side heads. Seven different sliding head combinations can be set up on this mill: turret and side head; ram and side head; two rams and one side head; ram, turret and side head; ram and turret head; two ram heads; turret head.

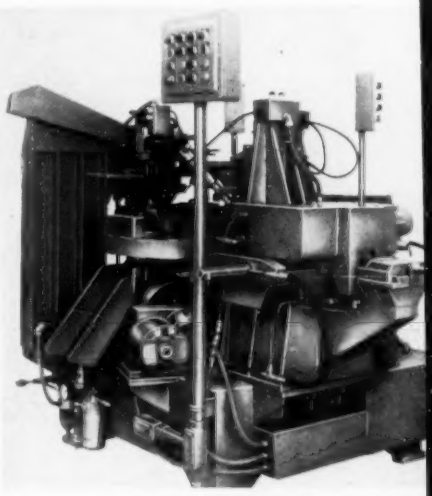
Maximum swing with side is 83 in. while maximum turning height is 59 in. Table diameter is 79 in. The machine will handle workpieces weighing up to 12 tons. Horsepower for main drive is 50.

Maserati Corp of America, 662 Main St., Westbury, L. I., N.Y. **T-5-10**



Contour Milling Machine

Three-dimensional production machining and milling is accomplished on this equipment which releases a tool spindle from straight line confines and produces highly accurate contour configurations in space. It enables mass



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Use as Bore Gage covering a range of .200" thru 5.090" and reading in .0001".

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The No. 99 incorporates a high quality dial indicator together with all the necessary gage heads and extensions. It may be used directly at your machines or clamped to your fixtures. Furnished in handsome plush-lined case.

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production, to tolerances as low as 0.0002 in., of parts with irregular surfaces and edges which must be machined.

The four-spindle machine bevels four feather edges of compressor blade roots. One part is completed every 18 sec.

Blades are gravity-loaded to an indexing table which carries them sequentially to two two-spindle work stations. Contour control at each of the work stations is accomplished by three contour templates on a hydraulic slide. Follower cams and inclined planes transmit the contours to spindle motion in all three planes.

Tri-Ordinate Corp., Berkeley Heights, N. J. **T-5-11**

Ultrasonic Soldering Iron

The Glennite ultrasonic soldering iron will join such materials as aluminum and magnesium and their alloys without flux. In operation, ultrasonic vibrations break the oxide layer of metals and alloys that form refractory oxides, and enable such metals to be effectively soldered without any special surface pretreatment.

Additional applications of the tool include surface tinning and the filling of blowholes in aluminum and magnesium castings, the soldering of light metal pipes or gutters which are not easily accessible for bench work and

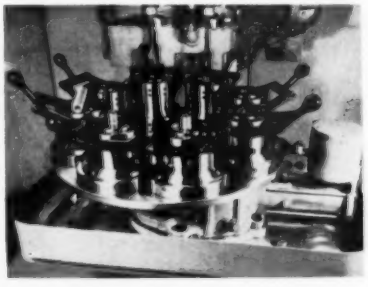
the assembly and installation of wave guides.

Because of the minimum loss in transmitting heat from the transducer to the soldering tip the ultrasonic technique permits higher soldering tip temperatures. The instrument can be utilized with electrically heated or gas heated soldering tips.

Gulton Industries, Inc., 212 Durham Ave., Metuchen, N. J. **T-5-12**

Indexing Unit

This fast indexing unit, with a 330-lb dial, indexes 90 deg with a smooth, shockless operation in as little as 7/10



second. Index control makes speed and dial load adjustable.

In the illustration, 3/4-in. diam, 4-pitch steel parts are being tapped, two per cycle by the Kaufman Model 66.

Kaufman Mfg. Co., Manitowoc, Wis. **T-5-13**

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Feeding Device

This orientation device will sort and orient cylindrical parts that are similar except for slight inside or outside diameter variations at one end.

The precise orienter is mechanically

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General Purpose Drills	Fast Spiral Drills	Chucking Reamers	Drill Length Reamers

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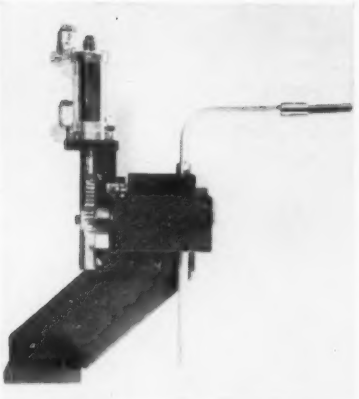


operated by 60 lb air pressure cylinder at speeds up to 150 parts per minute.

It accepts the parts at random; when a part is upside down (which is determined when it fails to match its own pattern) the orienter turns part over before allowing it to proceed in the feeding line.

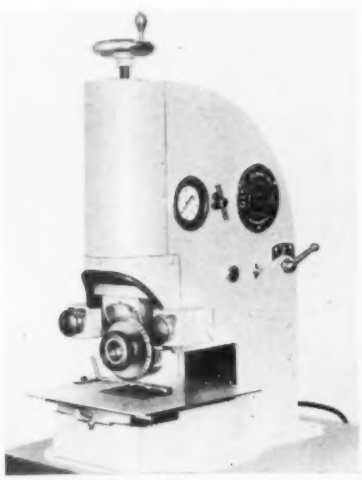
Peeco Div., Automation Devices, Inc., 3125 Brandes St., Erie, Pa. **T-5-14**

Plate Stamper

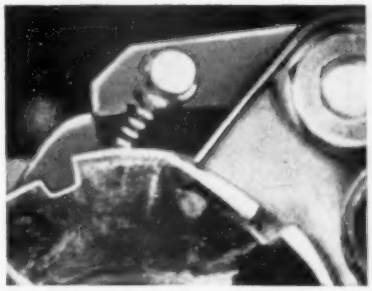
As a safety feature, both hands are required to cycle this pneumatic plate stamper. The switch arrangement is symmetrical about the dial, so that the machine is equally convenient for a left or right-handed operator. From 50 to 60 characters per minute can be stamped.

Operation is from 110-v single-phase 60-cycle electricity and shop air line of at least 40 lb. Stamping pressure is derived from the air line, and a self-contained pressure regulator allows selection of correct pressure. The table is set at the proper starting position by a hand knob.

The unit will mark plates of varying hardness—from soft brass to stainless

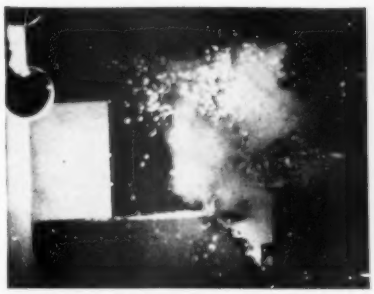


How to get easy answers to hard questions like these



1. Why excess wear in a ratchet feed?

2. How much spark to light a lighter?



3. How to control a food-puffing gun?

4. Why did gear teeth mesh erratically?

These questions have a common element: They all involve action that's too fast for the eye to see. Your first big step to getting the answers is to be able to see what's going on. With high speed movies you can slow down mechanical action (or fluid flow) enough to study it, take steps to make adjustments. The high speed movies above showed, for example:

1. How a bouncing pawl caused excess wear in a ratchet feed.
2. Where to place a spark wheel to get the best lighting action.
3. What exact timing must be maintained to work a food-puffing gun.
4. How torsion in a vertical shaft caused improper gear meshing.

Kodak's new High Speed Movie Film gives wide range to any industrial high speed camera. You can choose from eight different types of films that include black-and-white, full color, and black-and-white by infrared radiation.

Loading these versatile films into a Kodak High Speed Camera is a smart choice, too. It's simple to operate and requires no extensive photographic experience for successful use. And it gives all the speed you need for most industrial applications.

For details on how Kodak's High Speed Camera and Films might be used to help solve your product design or performance problems, send today for the illustrated booklet "High Speed Motion Pictures at the Service of the Engineer."

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the Kodak *HIGH SPEED* Camera

Kodak
TRADE MARK

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-167

steel—and will accommodate plates up to 6 x 8 in. from 0.012 to 0.062 in. thick. Plates up to ½ in. thick can be accommodated with special table and special gage.

Geo. T. Schmidt, Inc., 4100 N. Ravenswood Ave., Chicago 13, Ill. **T-5-15**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Deburring and Trimming Tool

The Roto-Edge cutter is designed for deburring or trimming sharp or uneven edges from workpieces and castings of various materials. The machine is powered by compressed air from any pressure source of approximately 25 psi.

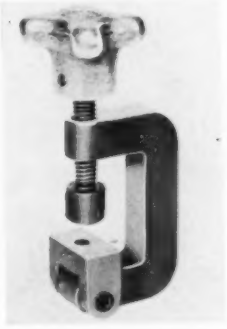
The workpiece is hand-held against two right-angled fences which are spaced to allow one edge of the material to project into the path of the cutting disk. Pressure on the foot pedal causes a rapid 8-in. downward stroke of the cutter head and disk, which cleanly planes off the projecting edge; release of the pedal returns the cutter head to normal position. Edge lengths up to 16

in. can be trimmed by reversing the workpiece after the first 8-in. pass. Stroke and return speed are hand-adjustable by means of a valve mounted on the foot-pedal housing. Depth of cut can be adjusted from 0 to ⅛ in.

AMF Tool Div., 224 Glenwood Ave., Bloomfield, N. J. **T-5-16**

Hinge Clamp

This type of hinge clamp may be mounted under the base or work table



or from the side. The clamp is available in various sizes.

West Point Mfg. Co., 26935 W. Seven Mile, Detroit 19, Mich. **T-5-17**

Contour Chasing Lathe

A 32-in. standard duty engine lathe automatically machines concave and convex contours on a spiral shaped part. The tracer unit is used to position the tool for each successive cut. Tool cutting motion is accomplished by

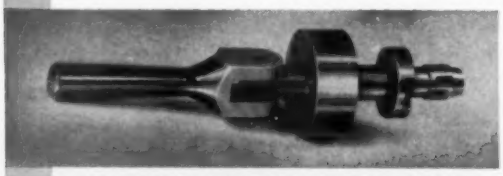
Add accuracy to your work—with

SPEEDGRIP EXPANDING LOCATORS

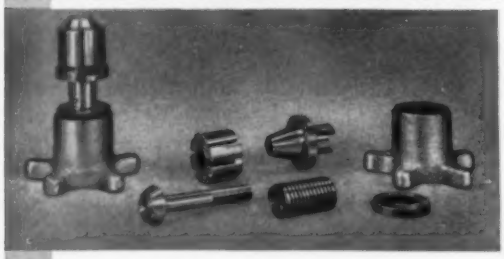
Outmode Solid Pin Locators

In loading or unloading work from fixtures, with Speedgrip Expanding Locators you can obtain location tolerances within .0002".

- Guaranteed to repeat fixture location accurately.
- Assures easier loading and unloading of work.



#0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from ⅛" to ¾" dia.



#2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.

This #5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from ⅜" to 11".

Write for Bulletin No. 24 for detailed description.

SPEEDGRIP CHUCK

Division of ERNEST, HOLDEMAN & COLLET, INC.

Elkhart, Indiana

SOME OPEN TERRITORY DEALER INQUIRIES INVITED

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-5-43—Bushings—*Acme Industrial Co.* Proper selection of bushings made easier with free drill bushing selector. (Page 43)

A-5-165—Dial Indicator—*Alina Corp.* Detailed brochure describes dial test indicator set No. 98 for measurements in deep holes. (Page 165)

A-5-212 — High-speed Steel — *Allegheny Ludlum Steel Corp.* New blue sheet describes properties of DBL-2 high-speed steel. (Page 212)

A-5-13—Bushings—*American Drill Bushing Co.* New catalog describes complete line of standard bushings. (Page 13)

A 5-34—Jig Boring and Milling Machine—*American Sip Corp.* Complete information on Hydroptic 6A jig boring and milling machine given in Catalog No. 1149. (Page 34)

A-5-12—Radial Drill—*The American Tool Works Co.* Features of the new American Hole Wizard radial described in Bulletin No. 328. (Page 12)

A-5-164 — Hacksaw Blades — *Armstrong-Blum Mg. Co.* New bulletins now available on Marvel cutting tools. (Page 164)

A-5-160—Air Tools—*The Aro Equipment Corp.* Bulletin 5546-T describes applications of Par-A-matic drills for production. (Page 160)

A-5-183—Carbide Tools—*The Atrax Co.* A 96-page standard reference on carbide tooling is now available. (Page 183)

A-5-53—Tooling Compound—*Bakelite Co., Div. of Union Carbide Corp.* New booklet describes Epoxy-Alloy tooling compound. (Pages 52-53)

A-5-10—Air Motors—*The Bellows Co.* Two new booklets, Bulletin ML-3 and BM-25, show how air motors are being used to cut cost. (Page 10)

A-5-15—Tape Control System—*Bendix Aviation Corp.* New brochure available describing the Bendix tape control system. (Pages 14-15)

A-5-195-1—Tap Grinder—*Edward Blake Co., Inc.* Free bulletin describes Blake Tap sharpening machines. (Page 195)

A-5-56—Surface Grinders—*The Blanchard Machine Co.* Illustrated folder No. 374 describes the Center Column surface grinders. (Page 56)

A-5-23—Radial Drill—*The Carlton Machine Tool Co.* Complete report on 3-month study of Programmer-pre-selector speed-feed control in Bulletin No. 110. (Pages 22-23)

A-5-214-2—Fixture Clamps—*Carr Lane Mfg. Co.* Clamp assemblies of all common types described in Catalog 5. (Page 214)

A-5-174—Press Drive—*Clearing Machine Corp., Div. of U. S. Industries, Inc.* Data on the Torc-Pac 20 describing the clutch and brake and the other features of the unit are available. (Page 174)

A-5-175 — Presses — *Clearing Machine Corp., Div. of U. S. Industries, Inc.* Sales Bulletin No. 19.84 describes a new low-priced press. (Page 175)

A-5-210—Optical Grinder—*Cleveland Grinding Machine Co.* Free brochure discusses the capabilities of the visual grind surface grinder. (Page 210)

A-5-234-3—Height Gage—*Cleveland Instrument Co.* Free bulletin discusses the Cleveland Indi-Ac, indicating height gage. (Page 234)

A-5-211—Tool and Die Services—*Cleveland Tool and Die Co.* Free brochure describes facilities of Cleveland Tool and Die for manufacturing precision tools and dies. (Page 211)

A-5-206—Carbide Tools—*Arthur A. Crafts Co., Inc.* Time and money-saving contributions from the tooling field described in free catalog called "Complete Carbide Tooling for Automatics." (Page 206)

A-5-172—Plastic Steel—*Devcon Corp.* Free catalog describes uses of industry for repairing castings and worn parts. (Page 172)

A-5-198—Press Feeds—*H. E. Dickerman Mfg. Co.* Free booklet has information on the complete Dickerman standard Press Feed line. (Page 198)

A-5-37—Photographic Equipment—*Eastman Kodak Co.* Illustrated booklet "High-Speed Motion Pictures at the Service of the Engineer" details how high-speed camera and films can help solve design problems. (Page 37)

A-5-167—Contour Projector—*Apparatus and Optical Div., Eastman Kodak Co.* Free booklet "Kodak Contour Projector" shows how optical gaging helps. (Page 167)

A-5-191—Engineering and Designing—*Ehrhardt Tool & Machine Co.* Facilities available at Ehrhardt described in free booklet "Triple Plus." (Page 191)

A-5-238—Broaching—*The Foote-Burt Co.* Circular No. 503 tells how to cut machining costs with broaching. (Page 238)

A-5-196-2 — Microscopes — *The Gaertner Scientific Corp.* Bulletin 161-54 shows applications, models and specifications of various microscopes. (Page 196)

A-5-194 — Threading Tools — *Hanson-Whitney Co., Div. of Whitney Chain Co.* Catalogs available on Hanson-Whitney machine tools, cutting tools and precision gages for threading applications. (Page 194)

A-5-5—Collet Chucks — *Hardinge Bros., Inc.* Different styles of Hardinge Sjogren collet chucks described in Bulletin 8B. (Page 5)

A-5-195-2—Live Centers—*Ideal Industries, Inc.* Complete data and specifications on Gold Band live centers available in new catalog. (Page 195)

A-5-201—Coolant Filtering System—*Industrial Filtration Co.* Delpark Dual manifold, vacuum Filter-matic Filter described in new bulletin. (Page 201)

A-5-36—Cutting Tools—*Cutter Div., The Ingersoll Milling Machine Co.* Catalog No. 66F describes complete line of Ingersoll inserted blade milling and boring tools. (Page 36)

A-5-250-1—Fixture Parts—*Jergens Tool Specialty Co.* Complete detailed specifications, engineering and cost-saving ideas in 364-page catalog. (Page 250)

A-5-228-1—Lathes—*Louis Levin & Son, Inc.* Catalog M describes complete line of lathes and accessories. (Page 228)

A-5-207—Straighteners—*F. J. Littell Machine Co.* Complete details on flexible press-feeding machines available in catalog. (Page 207)

A-5-240-3—Magnetic Tool—*Magna Driver Corp.* Manual describes complete line of Magna-Tip bit holders, finders, sockets and hand screwdrivers. (Page 240)

A-5-26—Carbide Tools—*Metal Carbides Corp.* Seventy-six-page catalog 56-G describes 50 sizes and styles of standard centerless grinder blades. (Page 26)

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A-5-250-3—Carbide Bushings—*W. F. Meyers Co., Inc.* Information and prices on Meyco carbide inserted bushings available in Catalog No. 42. (Page 250)

A-5-184—Subland Drills—*Mohawk Tools, Inc.* Free brochure entitled "Why Use Two . . . When One Will Do" gives ideas and suggestions on drilling. (Page 184)

A-5-186—Aluminum Castings—*Monarch Aluminum Mfg. Co.* Brochure "Manufacturing Achievements in Molten Aluminum" gives full details on finishing quality castings. (Page 186)

A-5-230—Millers—*The Robert E. Morris Co.* Details on the complete Nichols line described in Bulletin "The Millers that Use Their Heads." (Page 230)

A-5-70—Thread Chasers—*The National Acme Co.* Free copy of Booklet DT-52 is available, describing the use of Vers-o-Tools to reduce thread-cutting costs. (Page 70)

A-5-57—Induction Hardening—*The Ohio Crankshaft Co.* Free booklet, "Typical Results of Tocco Induction Hardening and Heat Treating." (Page 57)

A-5-55—Milling Cutters—*The OK Tool Co., Inc.* Fifty pages of new engineering prints shows advance ideas in multidiam. tools for boring, milling and reaming operations. (Page 55)

A-5-243-2—Hardness Tester—*Opto-Metric Tools, Inc.* Complete details on Frank universal hardness tester are available in Circular 505. (Page 243)

A-5-222—Power Brushing—*The Osborn Mfg. Co.* Free 20-page Brushamatic booklet shows use of power brushes. (Page 222)

A-5-228-3—Forming Tools—*Parkwood Laminates, Inc.* Technical bulletin and literature describe features of Hi-Den tool material. (Page 228)

A-5-208—Dial Indicators—*Petz-Emery Inc.* Complete line of dial indicators described in Literature D. (Page 208)

A-5-246-5—Tool Components—*Pic Design Corp.* New 32-page catalog and plastic tool design templates. (Page 246)

A-5-240-4—Boring Tools—*Precision Tool & Mfg. Co. of Illinois.* Catalog describes Deka Bore boring heads and bars. (Page 240)

A-5-251—Turning Tools—*R and L Tools.* New catalog describes complete line of cutting tools. (Page 251)

A-5-27—Air Cylinders—*Rivett, Inc.* New 20-page catalog describes squaremaster cylinders, clutches. (Page 27)

A-5-190—Clutches—*Rockford Clutch Div., Borg-Warner.* Typical installations of Rockford clutches and power take-offs described in Bulletin with complete engineering specifications. (Page 190)

A-5-179—Counterbores—*Schrillo Aero Engineering Co.* Catalog No. 103-G on Schrillo long-life counterbores and the name of nearest dealer available by request. (Page 179)

A-5-234-1—Coolant Unit—*Sealol Corp.* Bulletin describes Sealol drill adaptor and coolant supply unit. (Page 234)

A-5-234-1A—Gun Drilling—*Sealol Corp.* Informative booklet "An introduction to Gun Drilling" is available on request. (Page 234)

A-5-197—Toolholders—*Seibert & Sons, Inc.* New brochure describes current line of adjustable adaptors, tap and drill drivers and spindle assemblies. (Page 197)

A-5-168—Expanding Locators—*Speedgrip Chuck, Div. of Ernest, Holdeman & Collet, Inc.* Details of Speedgrip expanding locators in Bulletin No. 24. (Page 168)

A-5-158—Tumble Jig—*Standard Parts Co.* Free Tumble Jig bulletin describes details of new "Tumble" Box jig. (Page 158)

A-5-232—Socket Screws—*Standard Pressed Steel Co.* Fastener reliability information in copy of the new SPS booklet "Concerning High Reliability." (Page 232)

A-5-215—Steel—*The L. S. Starrett Co.* Detailed information and prices on low-carbon flat stock described in Bulletin No. 1110. (Page 215)

A-5-229—Honing—*Sunnen Products Co.* Five informative honing booklets describe typical applications in 105 cases. (Page 229)

A-5-244—Inspection Equipment—*The Van Keuren Co.* New 258-page Van Keuren catalog and Handbook No. 36 contains valuable technical and engineering information on measuring and methods. (Page 244)

A-5-156—Carbide Tools—*Vascoloy-Ramet Corp.* Complete information on all 14 V-R standard carbide grades is shown in V-R Bulletin 5803. (Page 156)

A-5-248-2—Radial Drill—*Veet Industries.* Free brochure of Veet's 16 points of superiority and name of nearest dealer available on request. (Page 248)

A-5-242—Tooling Specialties—*Vlier Engineering Corp.* New catalog on standard Vlier tooling accessories. (Page 242)

A-5-173—Grooving Tool—*Waldes Kohinoor, Inc.* New 20-page manual gives information on Waldes Truarc grooving tool. (Page 173)

A-5-220-2—Bending Methods—*Wallace Supplies Mfg. Co.* Two-hundred page manual on "Bending of Metals and Abrasive Cut-Machining of Metals" is available for $3 plus postage. (Page 220)

A-5-250-2—Bending Manual—*Wallace Supplies Mfg. Co.* Free 36-page manual shows use of bending equipment in user's plant. (Page 250)

A-5-224-1—Abrasive Cut Machine—*Wallace Supplies Mfg. Co.* Free 44-page book on Wallace benders and saws available on request. (Page 224)

A-5-181—Spindles—*Whitnon Mfg. Co.* Free literature gives engineering specifications on Whitnon high-frequency electric spindles. (Page 181)

A-5-248-1—Toolholder—*W. M. Ziegler Tool Co.* Catalog describes use of the Ziegler floating toolholder. (Page 248)

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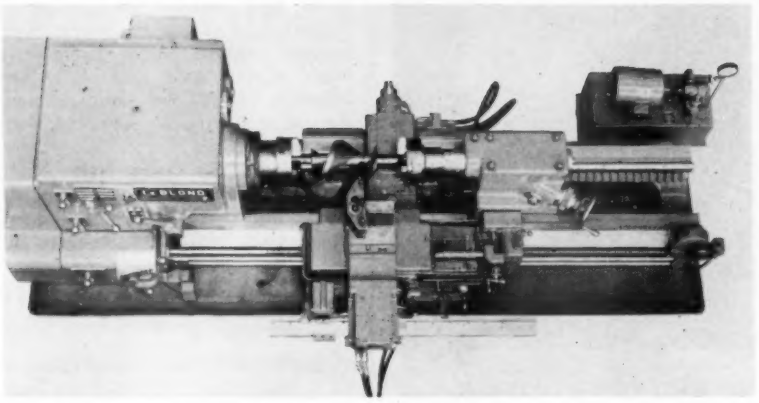


"chasing" the spiral in a manner similar to chasing threads. The tool is automatically positioned between cuts. Feeds are available from 0 to 0.070 ipm.

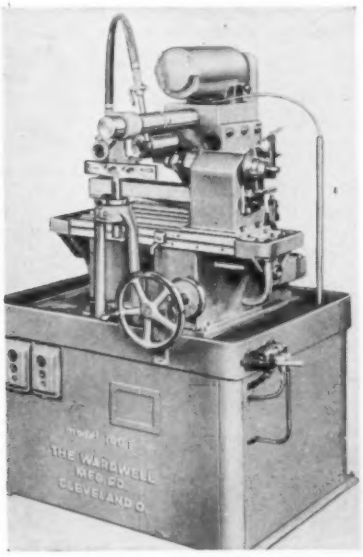
Automatic cycling built into the machine together with a tool release mechanism, allows automatic operation once setup is made. The workpiece is clamped by three jaw chucks in both the head and the tailstock. A special work driver and locating pin keep the workpiece from slipping while under cut, thus preventing any change due to the relationship of tool and workpiece.

The normal cutting operation on the left-hand rotor is from headstock to tailstock. The mating right-hand rotor is machined from tailstock to headstock.

R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. **T-5-18**

Milling-Grinding Machine

A hydraulically-operated automatic saw tooth milling and grinding machine, the No. 100F, is capable of performing these multiple operations:



milling form milling cutters; milling slitting and screw slotting saws; grinding saws; milling straight flutes in tools such as taps and reamers; milling or grinding other special dividing head work.

Designed to perform these operations in gangs at one setting, the machine automatically indexes a gang of saws, one row of teeth at a time. It also can mill saws up to 14 in. in diameter and in gangs up to 7 in. long. It will take 112 saws 1/16-in. thick, in one setting.

The Wardwell Mfg. Co., 3805 Ridge Rd., Cleveland 9, Ohio. **T-5-19**

Spray Equipment

Cooling and lubricating forming and cutting tools for metal and plastics is accomplished with spray equipment called Multi-Mister, which supplies a fine mist of coolant liquids or light cutting oils at the point of contact between the tool and the material.

It can be attached quickly to lathes, mills, screw machines, drill presses, power saws, internal and external grinders, jig borers, high-speed presses, broaches and machines not designed to work wet.

The equipment operates from the main air line without requiring regulators. It consists of one or more adjustable tip spray nozzles and brackets for mounting, flexible tubing to carry air and coolant to each nozzle, and supply tank equipped with suction tube, strainer and header to which the tubing is attached. There is no pressure on the tank. Each nozzle line has separate adjustments for both air pressure and the amount of fluid delivered.

Swivel tip spray nozzles permits spray to be directed easily and located as

NEW
MINIATURE
fluted
REAMERS
by L&I

New Tools for Miniaturization... Companion Tools for Micro-Drills

L&I announces a new line of miniature reamers which are standard in sizes from #80 (Wire Gage .0135) through #61 (Wire Gage .0390). These reamers are perfectly engineered miniatures of L&I larger straight shank straight flute reamers, ground from the solid. They are provided with end relief and are made to a tolerance of +.0002", −.0000"! They are also available in intermediate decimal sizes. A complete set of 20 reamers is also ready.

See your L&I Distributor now, or write for his name.

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For machinery repairs or rebuilding

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80% STEEL

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Proven in use by leading manufacturers, PLASTIC STEEL can cut costs, speed production in *your* plant. 1001 uses in industry — write for your copy today. FREE catalogue on request.

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DEVCON CORPORATION

300 Endicott Street, Danvers, Mass.
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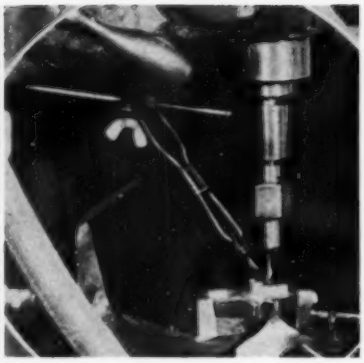

closely as possible to the point of actual cutting.

Fine particles of coolant are driven directly into the cutting area, usually from the underside, and there is no chance for curling chips to protect and insulate the high heat point.

The DeVilbiss Co., Toledo, Ohio. **T-5-19**

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Caliper Square

A Swiss tool, Polyplan caliper square, measures distances between points situated on two different axes. A hinged lower jaw rotates 180 deg in a plane parallel to the measuring surfaces of the jaws. When using the tool on a part that is being machined, measuring can in most cases be accomplished without removing the part from the machine.

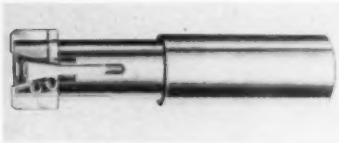
Lower scale of the vernier permits readings to 1/1000 of an inch, the upper scale has fractional divisions of inches.

Distributed by American and Overseas Trading Co., 900 Riverside Dr., New York 32, N. Y. **T-5-20**

Boring Tool

Hole sizes produced by this adjustable boring tool can be rapidly expanded or reduced without removing blades from the bar or removing the boring bar from the setup. Blades are expanded by a tapered socket head screw adjusted from the bar end. One full rotation expands cutters 0.020 in. on the hole diameter. Both blades are supported by V-tongues riding in V-grooves which maintain alignment of blade edges. Once set, blades are locked in fixed position. Multiple blade sizes fit each bar size, expanding overall range.

Because of its rigidity, the boring tool is capable of heavy cuts for roughing operations. The M-3 HSS cutters are specially efficient on stainless and



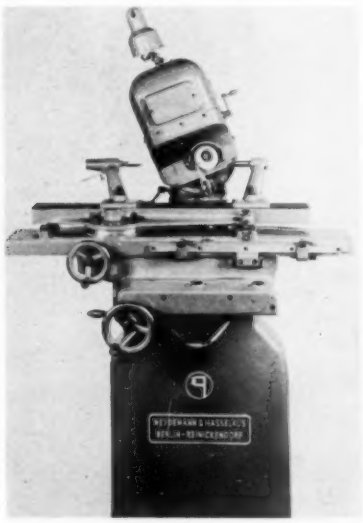
heat-treated alloy steels as well as on abrasive materials, such as cast iron and aluminum.

Standard bar sizes cover 1¼ to 4½-in. hole diameters.

Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif. **T-5-21**

Grinding Machine

This tool and cutter grinding machine offers a direct setting and reading of the clearance angle by tilting the grinding wheel into the desired angle and keeping the solid tooth rest in the center point of the radius. Once the machine is set up, no head height adjustments are necessary for cutters



of different diameters. For grinding primary and secondary clearance angles, adjustments are achieved simply by dialing the angle on a graduated scale.

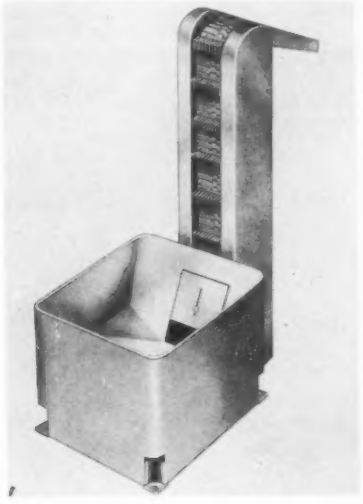
For spiral fluted cutters the head with the tooth rest can be tilted into

the helix angle. The wide face of the toothrest is always parallel to the cutting edge without need for a special adjustment.

Distributed by Cawi Machine Co., Inc., 34 Exchange Pl., Jersey City 2, N. J. **T-5-22**

Elevating Conveyor

The vertical elevating conveyor affords floor level loading to avoid high lift hopper filling. Outlet door in the bin is adjustable to control the flow of parts to the conveyor belt. Self-cleaning cleats minimize slowdowns due to



snarling or nesting of parts. A paddle type relay switch arm automatically starts and stops to deliver only the quantity of parts required in the feeder bowl. Hopper capacity is approximately 5 cu ft.

VFC Div., Automation Devices, Inc., Erie, Pa. **T-5-23**

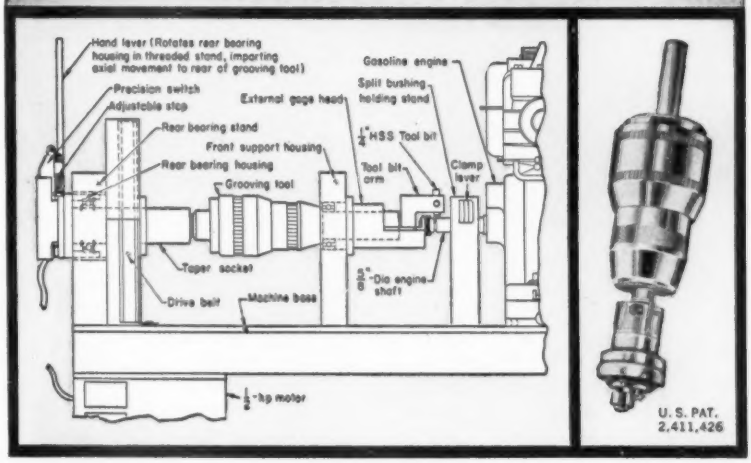
Automatic Press Loader and Transfer

Standard punch press lines can be fully automated to produce up to 18 pieces per minute through the use of standardized Press-Matic transfer units. This equipment automatically loads and unloads parts in and out of dies in any type of punch press and transfers parts between presses.

Machines are portable, floor-mounted, self-contained and equipped with both quick air and electrical connections. Units, which are placed in front of or behind each punch press, can automatically move the part in and out of two, three or even more dies in the same press.

Tooling can be adjusted to handle a

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



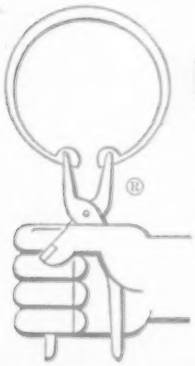
To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool. TE 050



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TRUARC®
GROOVING TOOL
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

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the Clearing Torc-Pac 20 O.B.I.

What do you want in a 20 ton O.B.I.?

Dependability, quiet operation, rigidity, accuracy, a trouble-free transmission and drive?

All these features and more have been incorporated into Clearing's new Torc-Pac 20 ton O.B.I.

The Torc-Pac 20 is compact, readily portable, complete with all necessary controls—ready to operate when you receive it. And it has a high performance, wet disc **air-friction clutch and brake** all wrapped up in a sealed-in-oil drive. Read more about it on the next page.

Why not find out more about this low priced press today. Write Clearing and ask for Sales Bulletin No. 19.84.

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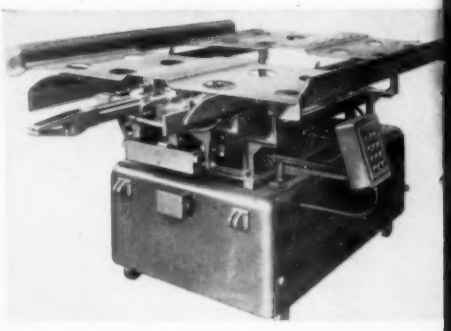


number of different parts over the same line. Retooling can be done from one model year to another to handle new parts.

Electrical interlocks and built-in features prevent the press from completing a cycle if a die fails to release the part.

Die & Automation, Inc., 5353 Dixie Hwy., Hamilton, Ohio. **T-5-24**

Carbide Boring Tool

Series 2015 solid carbide boring tools have a hardened and ground steel shank of standard $\frac{3}{8}$-in. diameter by 1-in. length. Standard shank design avoids need for changing collet and chucking setup; it is adaptable to standard, commercial boring heads without special bushings.

There are eight tools in the series with minimum hole diameter ranging

from 0.090 to 0.300 in.; the latter tool, C-7, has a maximum hole depth of $1\frac{1}{2}$ in.

This series will be stocked in grade C-2, while other grades will be available upon request.

A form relief incorporated in the tool allows resharpening in both planes, on the face and on the end.

Atrax Co., 240 Day St., Newington, Conn. **T-5-25**

Hydraulic Control System

This hydraulic control system, designed primarily for multiple nut-setting, delivers uniform torque to $\pm$ 1 ft. lb simultaneously to as many as 20 threaded fasteners of various sizes and bolt patterns.

The control system, called Thor-Draulic, eliminates need for production hand-torquing in most nut-tightening operations involving critical torque. The machines can be balancer, torque arm, bench or machine mounted depending

upon size and application, and can be adapted to control the driving of other multiple power tools in industrial assembly.

Torque is uniformly delivered to each threaded fastener by means of two-stage hydraulic driving.

In the first stage, the hydraulic motors are synchronized to relatively high speed to give fast rundown of threaded fasteners. In the second stage, they hydraulically shift into torque sychronization at a lower speed, simultaneously delivering identical torque through each spindle, regardless of the type of opposition or resistance, until all spindle movement ceases.

Power unit of Thor-Draulic contains a hydraulic pump, driven by an electric

motor. This unit, which occupies 2½ sq ft of floor space and stands only 3 ft high, is capable of powering up to 20 spindles located within a maximum radius of 30 ft.

A single valve control permits variation of hydraulic pressure and resultant delivered torque, with a torque range of 30 to 100 ft-lb. The machine has a rundown speed of 300 rpm.

Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill. **T-5-26**

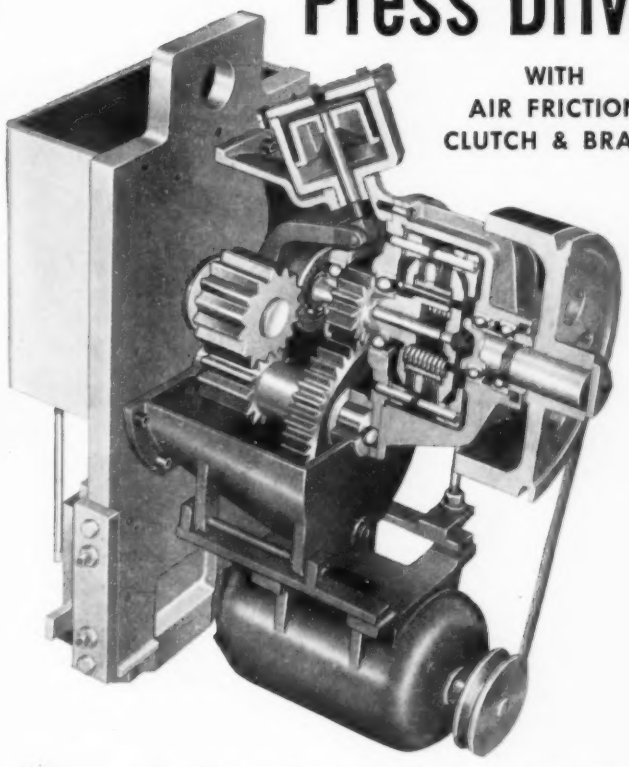
Jig Boring and Milling Machine

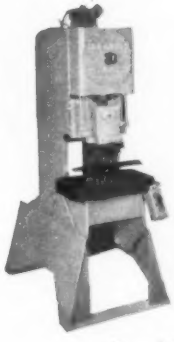
The Hydroptic High 7P vertical spindle jig boring and milling machine measures 63 in. between columns and can be used to machine to the center of parts 70 in. in diameter. There is up to 71-in. capacity spindle (quill retracted) to top of table, which has a working surface of 61¾ x 40½ in.

Accuracy of displacement for all settings of the work table and spindle

It has the New Torc-Pac 20 Press Drive

WITH AIR FRICTION CLUTCH & BRAKE





The Clearing Torc-Pac 20 has the unique press drive shown in cutaway above. The complete operating mechanism from main motor to slide is combined into a compact package separate from the press frame. This offers flexibility and accessibility that will cut maintenance costs to the very minimum. The clutch in this remarkable press drive is a completely new wet disc design. You will find no other like it in the press industry. The friction discs are submerged in oil. Films of oil between the plates actually "pick up" or start the engagement. Result? The linings don't wear the way conventional linings would. You never have to adjust the clutch. You can operate for years without replacing linings.

More data on the Torc-Pac 20 with its unique clutch and brake and other features is yours for the asking. Write Clearing.

Also available in 30 & 45 ton capacities

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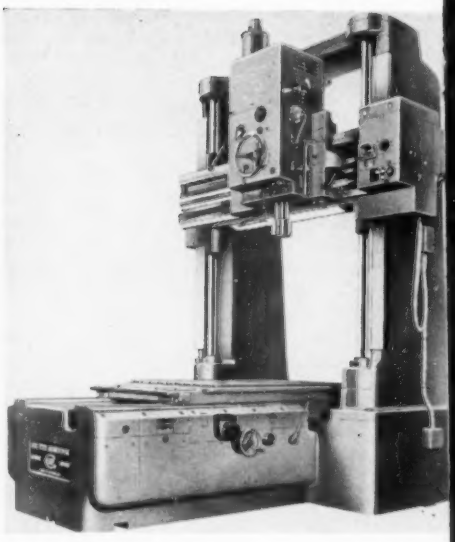

saddle is guaranteed to within 0.0002 in.

Distributed by American SIP Corp., 100 E. 42nd St., New York 17, N. Y.

T-5-27

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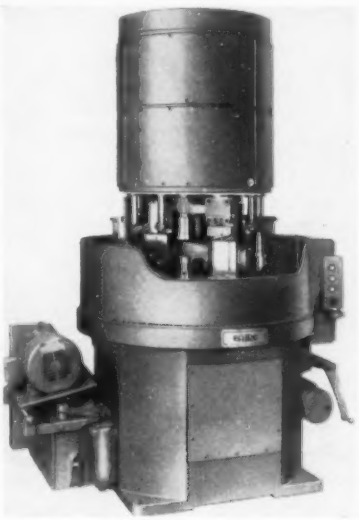
Continuous Lathe

Comparable to four high-speed precision lathes combined in a single unit, this 8-in. 4-spindle vertical continuous lathe may be tooled for economical



production of many jobs usually requiring special purpose equipment.

The lathe is not an indexing machine. All four spindles perform the same operations and are continuously in operation. Each spindle, in turn, be-

comes safely dead and automatically releases the work as it passes through the load and unload sector.

Each spindle has precision automatic workholding, with two vertical and one cross slide tool motions in any required combination.

Workholding devices are required by the job. Tool motions, feeds and speeds are automatically controlled. Full safety interlock is provided in the dead sector for manual load and unload. Automatic load and unload can be incorporated optionally.

Power application to spindles and tools derives from a single heavy central column which is readily accessible for installation, change-over or servicing of cams and gearing.

The Baird Machine Co., Stratford, Conn. **T-5-28**

Chuck and Collets

Extra-wide, flange topped locking rings on these solid one-piece chucks and collets provide hand protection for the operator. A smoothly flared, wide

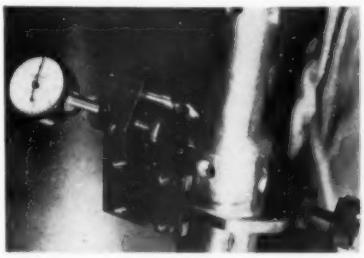
flange prevents greasy hands from riding up into the chuck and affords a secure grip by operator.

Jones & Lamson Machine Co., Springfield, Vt. **T-5-29**

Bit Setter

The cut or reset of any boring tool bit can quickly be duplicated to within 0.0001 in. of the original cut with the Setmaster boring tool bit setter. The standard Setmaster can set at least two tools, and multiple master screws can be installed for multiple tool setups. A master can set both roughing boring bits or finishing bit in one-step operations.

Three standard sizes are available: Model A, for bars from 3/8 to 7/8-in. diameter; Model B, for bars from 7/8



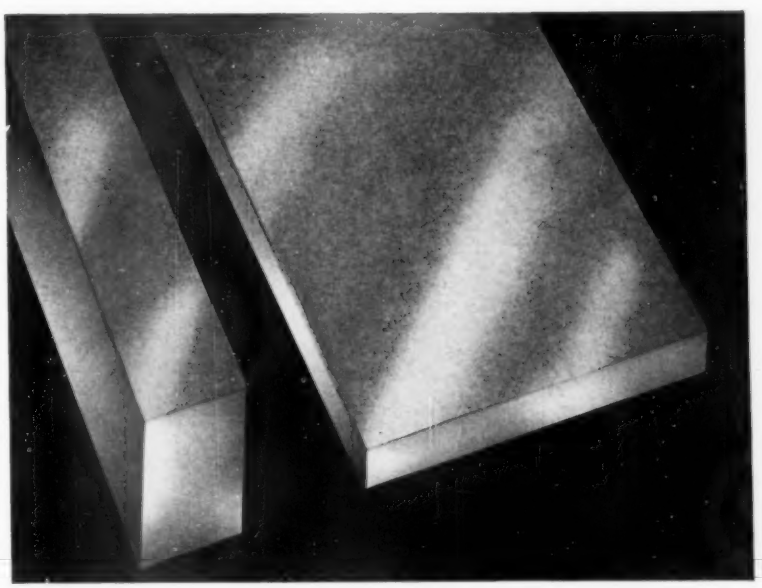
to 2-in. diameter; Model C, to fit bars from 2 to 4-in. diameter.

Aircraft Engineering and Mfg. Inc., 2A4 Norman St., Bridgeport, Conn. **T-5-30**

Transfer Machine

Purpose of this automatic transfer machine is to completely machine and probe parts having multidirectional operations performed upon them, without unloading and loading a second time. The machine can be tooled for more than twenty operations, predominantly of the basic machine tool type.

The machine, which can be of any economical length from four feet on up, will process parts of any kind or material whether produced from extrusion, die casting, permanent mold, sand casting or forging. The machine bed as shown is about 12-ft long, machined and T-slotted on both sides in order to receive sliding tables on which machining units and columns are directionally mounted. Any standard make of work



New Lamina Wear Plates Last Longer, Cost Less!

Now . . . save money and get better performance wherever you have sliding contact between flat metal parts! The principle of bronze electroplated on a steel backing originated with Lamina Bronze-Plated Guide Pin Bushings. Proven during countless millions of punch press hits, it is now being used successfully to produce flat wear plates.

This new concept in wear plate design combines the low cost, ready machinability and solid backing of steel with the long-wearing, non-seizing, free-running properties of a copper-tin bronze alloy. Lamina Bronze-Plated Wear Plates are flat, parallel, and can be easily machined to suit your application. Standard sizes available from stock. End costly wear problems and reduce expensive downtime now! Write for complete information.

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P.O. BOX 31, ROYAL OAK, MICHIGAN

Manufacturers of Lamina Guide Pins, Bronze-Plated Bushings, Progressive and Lamination Dies

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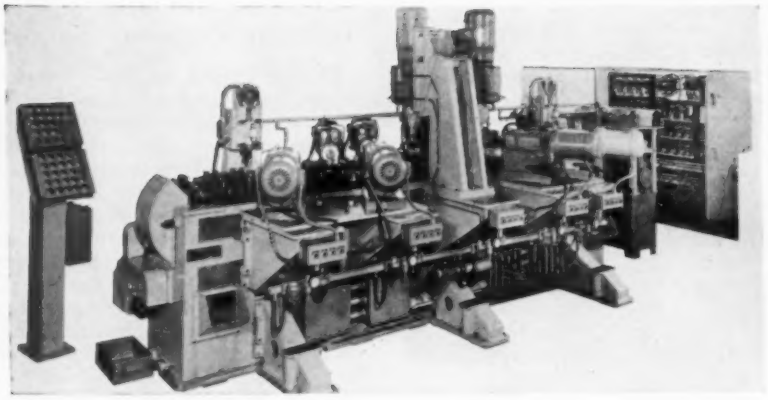


unit can be used; however all units should be of the same control nature.

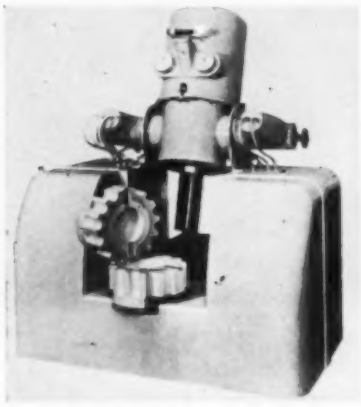
The machine illustrated has 20 stations, every other one of which is a work station. Each fixture can be approached with one or more work heads simultaneously.

Jeffrey Machine Tool Div., 23281 Telegraph Rd., Detroit 19, Mich. **T-5-31**

Vacuum Melting Furnace

Clino Model 20-V production vacuum melting furnaces are capable of making castings up to 15 lb.

When melting begins in this furnace, the mold is clamped over the pouring spout and the bell jar is attached to the furnace lid. When the metal is at correct pouring temperature, the complete furnace is inverted. When the



casting has solidified past the critical range, the bell jar is removed and mold is unclamped.

To change linings, the entire composite unit lifts out quickly and simply.

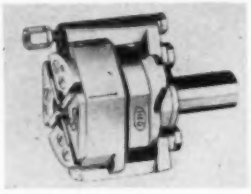
Department K40, British Machines and Foundry Supplies, Ltd., Port Washington, N. Y. **T-5-32**

Correction: Procunier Safety Chuck Co.'s leadscrew tapper was reported in the "Tooling for Competition" article in our April issue to have maximum travel of 5/16 inch. Actually, maximum travel for the tool is 1 5/16 inches.

Die Heads

Thread cutting self-opening aluminum die heads are light in weight which serves to reduce wear and vibration on the turret indexing mechanisms.

At present these die heads are made in size 00 style DMLN (alignment)



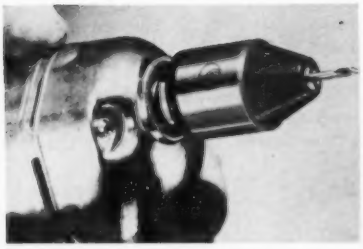
type with a 7/16 in. normal capacity. When necessary, 1/2 in. diameter in fine pitch, short threads can be cut.

In a test extending over several months, brass parts having a 15/32 in.-32 thread 13/32 in. long were threaded at 7200 rpm and finished in less than two seconds. Actual chaser cutting time was eleven hundredths of a second. The insert chaser averaged 50,000 pieces per grind and there was no wear on the turret slide or indexing mechanism.

The Eastern Machine Screw Corp., Truman & Barclay Sts., New Haven 6, Conn. **T-5-33**

Keyless Chuck

Because of the ball-bearing screw principle of construction, this keyless chuck for portable drills can be tightened by merely turning up the barrel of the chuck with the fingertips. After use, the jaws may be opened without the use of a tool. The chuck will not jam; will not loosen during drilling; and will always operate within acceptable limits of runout.



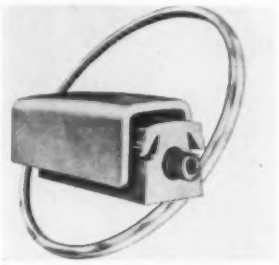
The keyless chuck is available in two models—both of which fit the 3/8-in. drill spindle. One is for electric drills. The second, a modification, is for air drills.

Supreme Products Corp., 2222 S. Calumet Ave., Chicago 16, Ill. **T-5-34**

Roll Neck Seal

Roll Neck Seal for bearings on work and back-up rolls in strip mills and rolling mills is entirely self-contained. It consists of two maintenance-free components which provide positive, two-way sealing to keep water out and lubricant in.

A flexible, specially compounded, long-wearing rubber element fastens to



and revolves with the roll neck. This element seals against the burnished walls of its housing which is stationary in the roll neck bearings.

All sealing takes place within the seal itself. Installation is quick and easy, and requires no roll neck or bearing modifications.

Syntron Co., 340 Lexington Ave., Homer City, Pa. **T-5-35**

Balancing Machine

Dynamic and static unbalance are indicated by both the single resultant and coordinate system methods on Model AEH 100c production balancing machine.

No graphs or slides are required. Conversion is made directly by the machine's electronic indicator unit showing the required correction weights in each plane by means of a microammeter and simultaneous color-coding lights. Points of correction from un-

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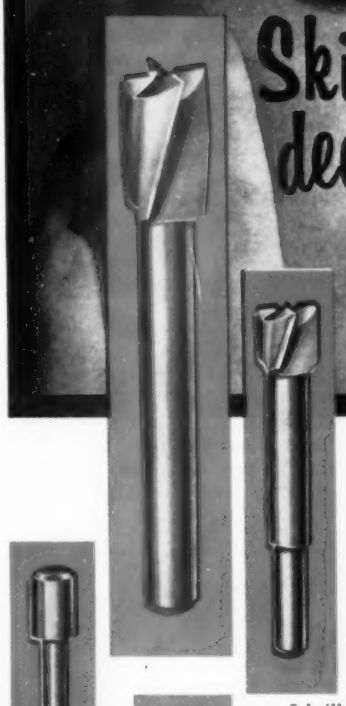

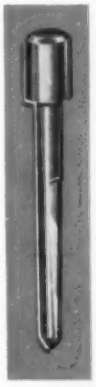

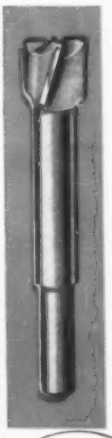

There's a Lot More to a Counterbore Than Just APPEARANCE!

If you have a big investment in discarded counterbores with bent or chuck-worn shanks, you are not specifying

SCHRILLO

Long-Life COUNTERBORES

Schrillo Counterbores are made from a single piece of high speed steel to provide the highest obtainable quality and longer wear.

The shanks are re-heat treated right in our own plant to give toughness, yet a hard surface is maintained to eliminate scoring due to repeated chucking and turning when in normal use. A hardened shank eliminates the all-too-frequent condition of bending that is common with soft shank counterbores. A counterbore that does not run true is subject to excess breakage of the cutting edges and, most important, spoilage of valuable work.

Pilot holes are lapped for accuracy. (2) Body and shank are both ground between centers for absolute concentricity. (3) A through knock-out hole permits quick removal of pilots. (4) Four flutes are standard to facilitate O.D. measurement and wear determination.

Aircraft-type Counterbores, designed for use in hand tools, are shorter, fit into a ¼" chuck. Aside from the chucking area, they have a heavy duty shank for greater strength and longer wear.

Counterbore Pilots may be used with either Regular or Aircraft-type Counterbores. Their exceptionally long life is the result of a very hard surface and tough core, perfect alignment, positive retention and absolute concentricity.

For Counterbores that *wear,* and WEAR, and WEAR always specify SCHRILLO!

SCHRILLO COUNTERBORES *are another in the great family of quality products made exclusively for the tooling and gaging industry — by* SCHRILLO.

Write today for Catalog No. 103-G *and name of dealer nearest you.*

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AERO TOOL ENGINEERING COMPANY
LOS ANGELES 46, CALIFORNIA

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balance thus can be predetermined in the design stage and provisions made for quick and safe removal or addition of weight.

The machine will handle parts up to 220 lb.

American Trebel Div., Kurt Orban Co., Inc., Greenwich, Conn. **T-5-36**

Centralized Coolant Systems

Using the principle of gravity feed, the Mistic Mist centralized cooling systems supply premixed coolant to any number of machines from a single supply source. The injector valve on the water supply line permits supply tank refill from floor level. Ratio of the mixture is governed by the size of the supply tank and the amount of concentrate dilution.

Individual control valves are mounted on each machine for immediate and precise control of air and coolant mixtures.

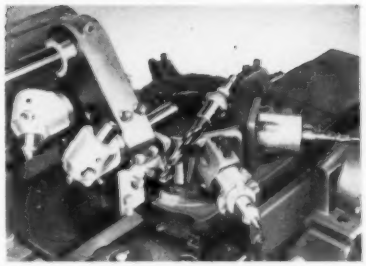
Mistic Mist control valves can be used singly or in banks, for manual or automatic control, with unlimited number of outlets. A selection of nozzle leads is available including 45, 90 deg or straight.

Aetna Mfg. Co., Bensenville, Ill. **T-5-37**

Turning Heads

A general purpose turning head equipped with vernier tool point adjustment is designed to perform a variety of turning operations from the turret of any make or type of horizontal turret lathe. Accurate adjustment and rigidity of the head permits heavy stock removal while it holds to precise limits of accuracy.

This tool can be preset outside the machine to part dimensions and positioned in the machine without further



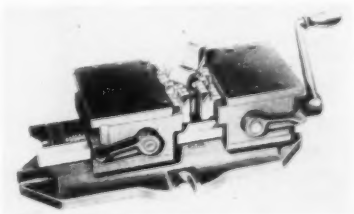
adjustment. Units may be applied to standard boring, turning and facing operations, and are especially suited for production and automated operations where machines must maintain close tolerances on long runs.

DeVlieg Microbore, Div. of DeVlieg Machine Co., 2720 W. 14 Mile Rd., Royal Oak, Mich. **T-5-38**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Vise

A multifingered vise, called Ampogrip, is designed to hold irregularly shaped pieces. It can be mounted as a holding fixture on the bed of a grinder, milling machine, planer or other machine. A number of them can be mounted together for easy positioning of odd-shaped pieces for multiple machining. Because of its strong holding power,



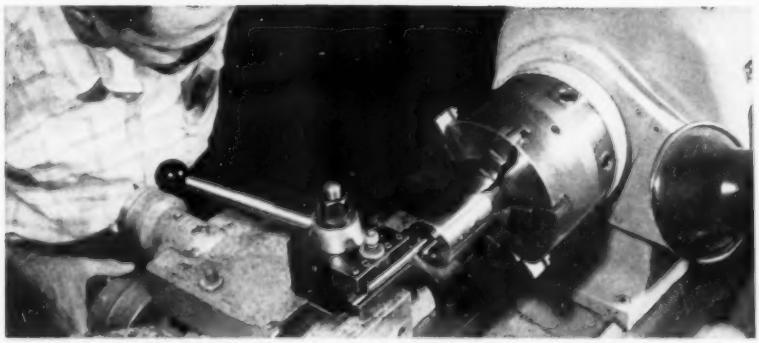
the vise permits heavy cuts and high-cutting speeds. The vise also can be used as a lathe chuck when turning odd-shaped parts. Available jaw sizes range from $1\frac{5}{16}$ to $6\frac{1}{4}$ in.

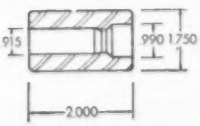
E. W. Bliss Co., Die Supply Div., 1375 Raff Rd., S.W., Canton, Ohio. **T-5-39**

Drilling and Boring Machines

Model 3AR double box column vertical drilling and boring machine, produced for use with automatic positioning (or spacing) tables, will accommodate tape or hydraulic controlled positioning tables. When so equipped the machine speeds hole-drilling production by positioning the work under the drill faster without jigs. Because

MONARCH LATHE with *Buck* AJUST-TRU® CHUCK "Cuts blind boring time 10% to 90%"





Add precision to precision and you're bound to end up with more precision. And that's the result of using the Monarch lathe with the Monarch "Air-gage Tracer" *plus a Buck chuck* for close-limit blind boring. In the job shown, Monarch cut a 2 hour job to 15 minutes, tolerances within ± .0005". They report production increases of from 10 to 90% on similar work.

In any tool and chuck combination—*"It pays to chuck with Buck!"* Send for catalog for full details.

BUCK TOOL COMPANY

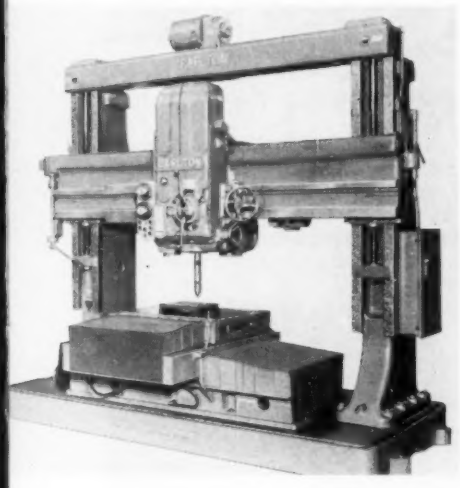
533 SCHIPPERS LANE • KALAMAZOO, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-180

of the automatic positioning table and the rigidity of double box column construction, it assures precision drilling-boring as well as spacing.

Vertical travel with rail on box posts, is 27 in.; vertical travel, with spindle in head, is 18 in. Distance from floor to spindle ranges from 30 in. min to 75 in. max. Horizontal head travel on rail is 28 in. There are 36 spindle speeds ranging from 1 to 100 rpm, while 18 feeds range from 0.004 to 0.125 ipm.

The machine offers twin screw elevating for the rails; headstock movable

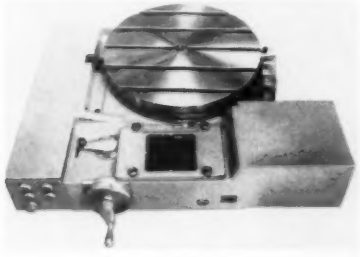


to facilitate loading and unloading of positioning table; choice of preselect or manual shift spindle speed control; hand feed wheel equipped with micrometer adjustment dial for precision depth boring.

The Carlton Machine Tool Co., Cincinnati 25, Ohio. **T-5-40**

Rotary Tables

Designed to adapt most milling, drilling and boring machines for a broad variety of operations, these rotary



tables are motor-driven and completely self-contained and require no connection to supporting machine. They can be moved quickly and easily from one machine to another, and plugged into any electrical outlet to be ready for operation.

The 24-in. rotary table, illustrated for use in horizontal position, has four control buttons for feed, rapid traverse in either direction and "stop." By mounting the electrical controls in a separate panel on a pedestal stand the table can be used in a vertical position. With separate electrical controls, the table can be equipped with both automatic positioning and automatic milling cycles.

The tables also are made in 20, 30 and 42-in. sizes; also in 48-in. size which can be equipped with 60-in. subplate. Standard tables will carry work loads of 5000 lb; special bearings increase work load capacities up to 50,000 lb.

W. B. Knight Machinery Co., 3920 W. Pine Blvd., St. Louis 8, Mo. **T-5-41**

Gear Coupling

The 162M coupling, which can take up to 1800 in-lb torque is first in the company's Series M line requiring no lubrication and allowing interchangeable bushings.

accent on Accuracy!

Whitnon HIGH FREQUENCY ELECTRIC Spindles

Modernize your present internal grinders and special milling machines with Whitnon High Frequency Electric Spindles

It's the accent on accuracy that gives this missile perfect performance at high speeds

It's the *accent* on accuracy, too, that builds perfect high-speed performance into Whitnon High Frequency Spindles. Whitnon Spindles deliver maximum — and vibrationless — horsepower to all grinding wheels and tools . . . at speeds from 10,000 to 120,000 RPM.

Spring pre-loaded and dynamically balanced after assembly, they assure you better control of finish and size — faster stock removal — and the high quality production that earns you higher profits.

IN STOCK TO FIT MOST GRINDERS
8 HP at 10,000 RPM to ¾ HP at 120,000 RPM

Available for:
- HEALDS
  - 3" Center Height
  - 3½" Center Height
  - 4" Center Height
- BRYANTS
- SPECIAL SPINDLES for duplicating, wood and non-ferrous routing, synthetic textiles and spin testing.

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THE Whitnon MANUFACTURING COMPANY
ROUTE 6 AND NEW BRITAIN AVE., FARMINGTON, CONNECTICUT

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NOW! *Adjustable Diameter and Open*
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Adjustable Diameter
BALL BUSHING
for Zero Clearance

The BALL Bearing
for *all* your **LINEAR MOTIONS**

Precision Series "A" and
Low Cost Series "B" BALL BUSHING

Open BALL BUSHING
for Zero Clearance on
Supported Shaft

Sliding linear motions are nearly always troublesome. Thousands of progressive engineers and designers have solved this problem by application of BALL BUSHINGS on *guide rods, reciprocating shafts, push-pull actions,* or for support of *any mechanism that is moved or shifted in a straight line.*

Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

LOW FRICTION • ZERO SHAKE OR PLAY
ELIMINATE BINDING AND CHATTER
SOLVE SLIDING LUBRICATION PROBLEMS
LONG LIFE • LASTING ALIGNMENT

The various types cover a shaft diameter range of ¼" to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

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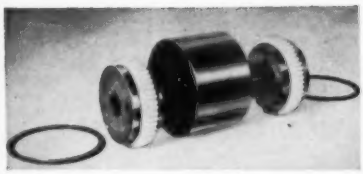
Also Manufacturers of NYLINED Bearings . . . Sleeve Bearings of DuPont Nylon, and 60 CASE . . . Hardened and Ground Steel Shafting



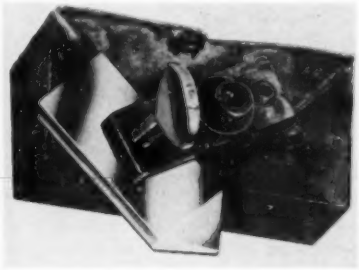
Stress relieved, injection molded nylon gears make possible the no-lubrication feature. The gears, which are held in place on the steel hubs by spring rings, make a smooth, resilient contact with the steel sleeve.

The interchangeable bushings are available for shaft sizes ½ to 1⅝ in.

John Waldron Corp., New Brunswick, N. J. **T-5-42**

Drill Pointing Fixture

All sizes of flat spotting and centering drills may be repointed for either right-hand or left-hand cut on each side of this fixture. One side holds the drill for a 90 deg included angle, the other side for 118 deg. Drills are solidly held

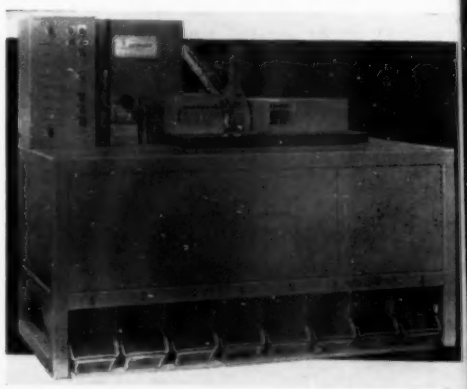


in position by a clamp tightened with a thumbscrew. With the fixture, pointing drills is a surface grinding operation, requiring no skill.

B & W Precision Products Co., P. O. Box 3865, Detroit 5, Mich. **T-5-43**

Gaging and Sorting Machine

Gears and nongear parts are automatically gaged, sorted and counted with this machine into eight various



size categories at the rate of 1200 parts per hour. Using quickly interchangeable tooling, a wide variety of gear and nongear parts may be handled automatically at high production rates. Gaging limits and production speed are easily and accurately changed. Use of standard electrical and mechanical components simplifies operation and maintenance. Simplified method of setup and changeover minimizes down time and does not require specially trained personnel. The unit which permits quickly interchangeable tooling, operates on 110 volts a-c., 200/250 w and 70 psi air pressure.

Garrison Machine Works, Inc., 515-525 Bannock St., Dayton 4, Ohio. **T-5-45**

USE READER SERVICE CARD ON PAGE 169 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Template Milling Machine

Developed for the economical and accurate production of flat templates, the Studer SFM 500 milling machine will produce flat templates for any machine using templates.

Operating on the coordinate principle, it has longitudinal and traverse slides which are positioned accurately by means of precision scales and microscopes reading to 0.0004 in. Range of

the setting optical system is 20 x 8 in. For producing cam type templates a rotary table, graduated in 360 deg, is mounted on the traverse slide. One turn of the handwheel equals 2 deg. A reading of 15 sec of an arc can be obtained.

Incorporated in the vertical spindle is a taper sleeve to accommodate collets and center punches. A three-position turret, fitted with adjustable stops, is provided for depth control.

Cosa Corp., 405 Lexington Ave., New York 17, N. Y. **T-5-46**

Atrax PROGRESS REPORT

SOLID CARBIDE TOOLS

CASE HISTORY #27
MAJOR INDUSTRIAL MANUFACTURER

Atrax END MILL
Series 1604
¼" RH Spiral

OPERATION Milling ¼" slot to .045" depth
MATERIAL Cast Iron
SPEED-FEED 8,000 r.p.m.
PRODUCTION Atrax solid carbide end mills operated 20 hours continuously with no apparent wear.

CASE HISTORY #40
EASTERN AIRCRAFT MANUFACTURER

Atrax E 141 BUR
Extra Coarse

OPERATION Burring piece parts
MATERIAL Aluminum
SPEED-FEED 20,000 r.p.m.
PRODUCTION One Atrax solid carbide bur produced same number of parts as 48 HSS burs.

CASE HISTORY #49
EASTERN ELECTRONICS MANUFACTURER

Atrax #53 DRILL
Series 1815

OPERATION Drilling
MATERIAL Glass base melanine
SPEED-FEED Standard speeds, hand fed
PRODUCTION One Atrax solid carbide drill outlasted 1200 HSS drills.

Atrax

SEND TODAY for 96 page "STANDARD REFERENCE" on Carbide Tooling!

THE ATRAX COMPANY
Newington 11, Connecticut

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WHY USE TWO··

A FEW EXAMPLES OF HOW MOHAWK SUBLANDS MORE ECONOMICALLY ACCOMPLISH TWO OR MORE DIAMETERS WITH ONE TOOL IN ONE PASS

Let Mohawk prove to you that a Subland is the most efficient and economical tool to use for multiple drilling operations. Check your maintenance costs along with the number of pieces per grind. Mohawk will guarantee you a savings.

WHEN ONE WILL DO!

Why use two—or more standard twist drills to accomplish a multiple diameter cavity when *one* Mohawk Subland tool will do the job in *one* pass . . . and, do it more efficiently, accurately and economically!

Why overload yourself with an assorted inventory of ordinary drills when you can save time, money and equipment by combining your requirements in a few versatile, accurate Mohawk Subland tools.

One Mohawk Subland tool will outwork and outlast dozens of ordinary drills. Because Sublands are infinitely accurate and they can be repeatedly reground (in your shop) without losing their concentricity.

Examine your hole costs, then see for yourself how many places a Mohawk Subland could easily and effectively handle the job and reduce your hole costs all along the line.

Normal Delivery on
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Size Optional — 3 to 7 Days from receipt of order!

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and let a Mohawk engineer prove just how easy it is to save your time—money and tools through the use of Mohawk Sublands.

YOURS FOR THE ASKING

Request your copy of the new Mohawk brochure entitled "Why Use Two . . . When One Will Do". You'll find it's loaded with interesting ideas plus dozens of suggestions that will save you drilling dollars.

world's largest producers of Sublands

Mohawk TOOLS, Inc.

Montpelier, Ohio

Men at Work

Directors of The Eastern Machine Screw Corp. elected **Charles W. Wesson** executive vice-president and general manager of the company. Immediately previously, stockholders had elected him a director of the firm. Mr. Wesson has been general manager of Eastern Machine Screw since October, 1956.

At a special meeting of the board of directors of Bay State Knife Co., Inc., **Robert H. Kean** was elected president and treasurer of the company. As president, he succeeds the late Frank H. Kean, founder of the company. The board also elected **Arthur H. Kean** vice-president of the firm. Both Messrs. Robert Kean and Arthur Kean are members of ASTE's Boston chapter.

Willard J. Harter has joined Hanson-Van Winkle-Munning Co. as chief mechanical engineer and will head all mechanical design engineering. Previous to this appointment he was associated with the Hydraulic drives department of Westinghouse Electric Corp. where he was a section manager.

Appointment of **Louis J. Pedicini** to the post of manager of manufacturing engineering of Congress Die Casting Div. and Congress Drives Div. was announced by Tann Corp.

Carl F. Stugard was elected a vice-president of Cincinnati Milling and Grinding Machines Inc., sales subsidiary of The Cincinnati Milling Machine Co. He is manager of their special machine tool division.

Victor Brown, executive vice-president of Kropp Forge Co., was elected president and general manager of Kropp Steel Co., wholly owned subsidiary. He has been associated with Kropp Forge since 1942.

Elmer J. Lell has been appointed vice-president in charge of Colmonoy Div. operations of Wall Colmonoy Corp. Associated with the company for the past ten years, he has been vice-president-sales.

Emhart Mfg. Co. has announced appointment of **John W. Murray,** formerly assistant manager of the research, development and engineering operations, as manager of the department.

Selas Corp. of America has named **C. Glen Bigelow, Jr.** to the newly created post of director of research. Mr. Bigelow goes to Selas from American Machine and Foundry Co. where he served as technical director of the General Engineering Laboratories.

New executive assignments have been made public at Modern Engineering Co. **I. F. Fausek** is now chairman of the board and **I. F. Fausek, Jr.** is president of the company. Three vice-presidents are **Willis L. Reedy** for production, **Al V. Fausek** for sales, and **James F. Fausek** for industrial sales.

Election of **Kenneth H. Meyer** as vice-president was announced at C. B. Hunt & Son, Inc. He previously was director of engineering.

G. M. Stickel, formerly vice-president and general manager of Landis Machine Co. was elected president and general manager. As president he succeeds J. H. Elliott who became board chairman and vice-president.

Ross L. Gilmore took office as president of Steel Founders' Society of America for the 1958-59 term at the society's recent annual meeting. He is president of Superior Steel & Malleable Castings Co.

Wade H. Shorter, Jr. has been elected a vice-president of Emhart Mfg. Co. He previously held the post of general manager of the company's research, development and engineering operations.

H. W. Whitman was elected vice-president and general manager of the Machine Div. of The Torrington Mfg. Co. A veteran of 10 years with the division, he has been general manager since early last year.

WHICH MONARCH FINISH WILL STIMULATE YOUR SALES?

Gleaming Polish highlights many of today's "best-selling" products produced from Monarch aluminum permanent mold and diecastings.

Colorful Porcelain Enamel offers a modern decor to create "buy appeal". "Porceglaze" economically adds a new feature to products made from Monarch permanent mold castings.

Durable Velvaglaze provides a pleasing, economical scar and mar resistant finish on both Monarch aluminum permanent mold and diecastings.

Monarch is famous for finishing quality castings. It will pay you to get full details. Write for our brochure "Manufacturing Achievements in Molten Aluminum".

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MONARCH ALUMINUM MFG. COMPANY

9205 Detroit Avenue Cleveland 2, Ohio

INDICATE A-5-186-1

Among officers elected for Dixie Tool Co. recently were **Ernest Swaine**, who became company president and general manager, and **Milo Shaner** who is now vice-president and assistant general manager.

The Cyril Bath Co. has made public the appointment of **Frank J. Phillips** as vice-president and general manager. He has been sales manager since 1952 and a director since 1956. Mr. Phillips succeeds Richard Humiston, former executive vice-president, who resigned last January.

William F. Boyle, general manager of the Pelton Div. of Baldwin-Lima-Hamilton Corp. has been made general manager of the Hamilton Div. succeeding **Walter A. Rentschler** who resigned. Mr. Boyle is a vice-president of B-L-H.

At the same time, **Ira Morgan White**, chief engineer at Pelton, was elected a vice-president of the corporation and named to succeed Mr. Boyle as Pelton general manager.

Stanley O'Dette was elected vice-president and director of Alsop Engineering Corp. He also is chief engineer and has been since January 1957. Mr. O'Dette recently retired after 30 years in the petroleum industry. For 10 years he covered the entire Western Hemisphere, Iceland, Europe and North Africa giving special technical service on industrial applications and problems associated with the economic climate of those areas.

Walter S. Dobleske has been made director of installation and service by Turchan Follower Machine Co. where his duties will consist of both national and international installation and service of machines and tracer controls. He has been with the company since 1946.

Appointment of **Robert S. Root** as chief engineer of both the clutch division and machine tool division has been revealed by Lipe-Rollway Corp. Chief engineer of the clutch division since 1953, he succeeds **E. R. Fish** as chief engineer of the machine tool division.

Cincinnati Milling Machine Co. has named **Carl Schonhoft** manager of grinding machine sales and **Curtis Altbaier** manager of special machine tool sales. Mr. Schonhoft has been assistant manager of grinding machine sales and Mr. Altbaier was an overseas field representative.

Snap-Tite, Inc. has announced promotion of **E. E. Saloum** to chief engineer, responsible for development, design and testing of the line of special purpose quick-connect couplings.

UNIQUE "ONE SOURCE" CASTING ANALYSIS

Offers "More Casting Value Per Dollar" in Monarch

✔ALUMINUM PERMANENT MOLD

✔ALUMINUM DIE CASTING

✔FUNCTIONAL ZINC DIE CASTING

Effective value analysis requires experienced judgement and knowledge of all methods involved. Years of experience in design and production of aluminum permanent mold, aluminum and zinc die castings, ready for assembly—enables Monarch to give you factual costs and impartial design analysis.

SaveTime. Save Money. Contact Monarch on your casting requirements. Monarch produces the finest castings that can be made by each method. Send today for our new brochure—"Manufacturing Achievements in Molten Aluminum".

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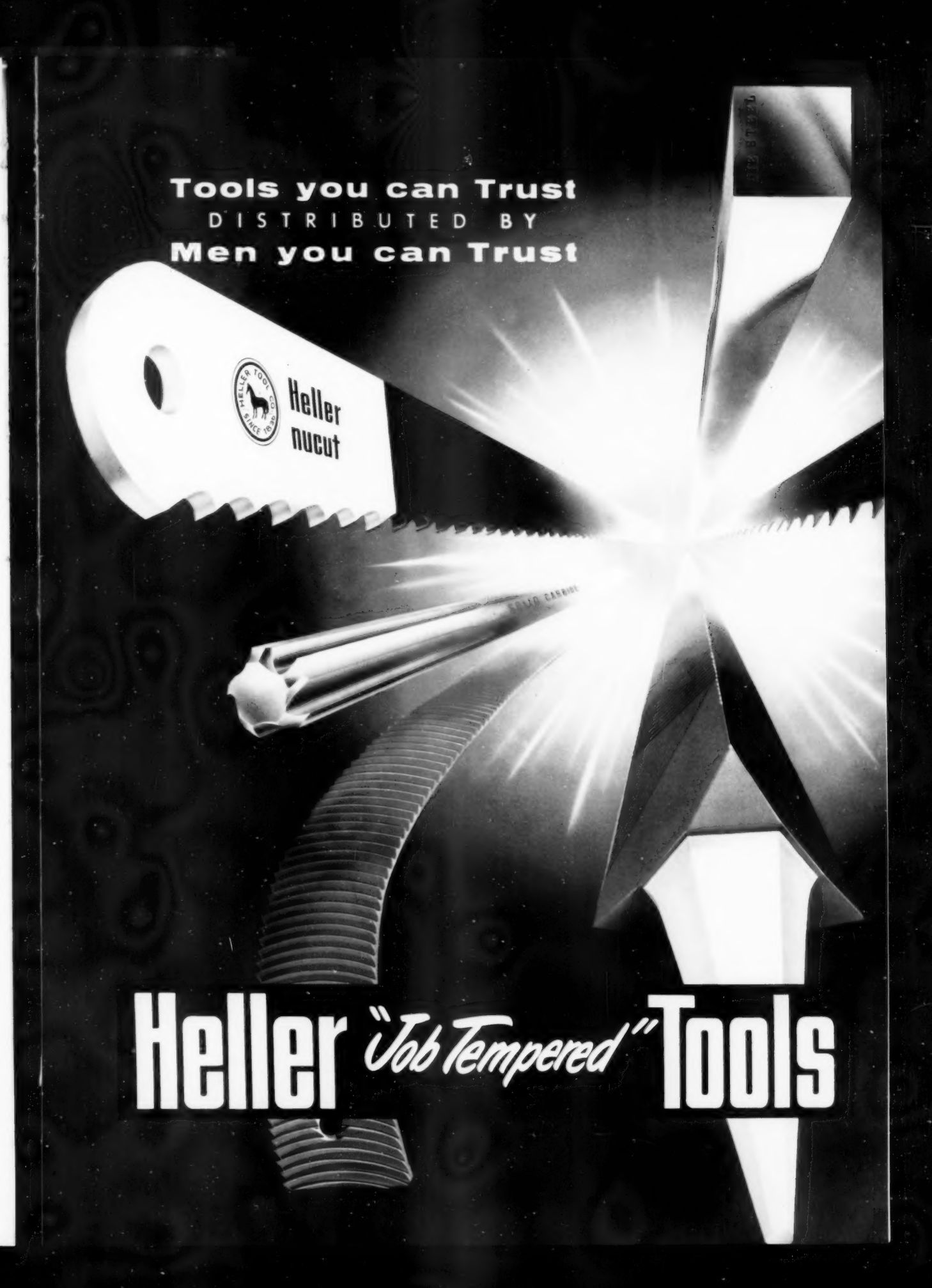
INDICATE A-5-186-2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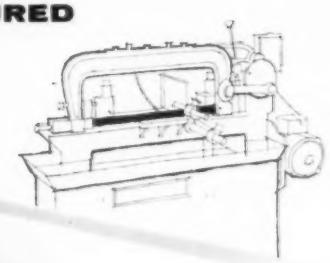

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Hack Saw Blades

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Combining its years of tool-making experience and unique heat-treating techniques, Heller converts tough, job-mated steel into uniformly tempered hack saw blades. So, you can trust these Job-Tempered blades to cut better over longer life.

ALL HELLER BLADES ARE CERTIFIED
by American Standards Testing Bureau. You can take the word of this impartial authority that the complete line of Heller JOB-TEMPERED hand and power Hack Saw Blades have the uniform teeth, uniform set and uniform temper that add up to trouble-free cutting.

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His broad inventory and prompt delivery keep you supplied with the blades you need as you need them . . . allows you to keep your own inventory at a practical minimum.

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MEN YOU CAN TRUST
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SERVICE + STOCKS = SAVINGS

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HELLER TOOL CO. SINCE 1856

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

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FIELD notes

Wheelabrator Corp. has announced an educational grant of $100,000 from the Wheelabrator Foundation to the Foundry Educational Foundation. Major provision of the grant is for 50 fellowships of $1,500 each to be distributed during the next ten years. Remainder of the grant, $25,000, can be used by F.E.F. for fellowships, scholarships or other educational purposes. The program is in immediate effect with the first recipients scheduled to begin study in the fall of 1958. Applications for graduate fellowship awards may be obtained from the F.E.F. office in Cleveland.

The Foundry Educational Foundation, established in 1947 by six organizations serving the foundry field, is dedicated to an extensive program of fostering and improving education in foundry science, engineering and operation.

expansions

Major plant expansion by Buhr Machine Tool Co. has increased production capacity by approximately 75 percent. Approximately half of the $1-million expenditure covered cost of two main bays—one devoted to heavy machining and the other to assembly of multiple-operation machines—and the second half covered purchase of new equipment. The latter consists of two giant tools: a double bed Gray planer type milling machine and a radial drill press mounted on rails serving a series of beds.

v v v

Recently completed general office building for the Dynamatic division of Eaton Mfg. Co. represents the final phase in a $2,300,000 expansion program which has been carried on during the past two years. To assure future growth, the design of the 21,500-sq ft building provides for expansion to the north with minimal disturbance to occupancy.

v v v

A 50-percent expansion is underway to increase the size of the West Coast plant of United States Chemical Milling Corp. The latest addition in space, Plant No. 3, will house special facilities of the company's recently acquired forming and shaping subsidiaries—Missile-Air and Hydro-Metal Spinning corporations. The added structure, representing an investment of more than $500,000, and its associated equipment will complement USCM's present capabilities for chemical milling and also for additional production operations which will make the firm a more versatile subcontractor.

v v v

Handy & Harman recently celebrated the opening of its sixth gold and silver-using factory in El Monte, Calif. This also is the company's first wholly new operation west of the Rockies. The plant, designed for fabrication and recovery of precious metals and their alloys, covers a total area of 25,200 sq ft and is equipped with modern metallurgical facilities, as well as efficient office and administrative facilities to speed handling of customers' orders. The plant replaces the former Handy & Harman plant in the Los Angeles area, providing more than double its production area, with room for additional future expansion.

v v v

An expansion program at its River Rouge plant has been announced by Solar Steel Corp. This will double the size of office facilities and increase certain plant areas. Plans are being made to transfer the staff, inventory and equipment from the company's Mt. Elliott plant to the enlarged facilities so that by June 1st Solar's Detroit division will be completely integrated and operating from one enlarged plant at River Rouge.

new companies

A new operating concern, called Control Systems Co., has been established by Hancock Industries. It will assume responsibility for development, design and marketing phases of an electro-mechanical control and monitoring system, applicable to product manufacturing. Currently, the system, named The Hancock Telecontrol, is manufactured at the Control Systems Co.'s Jackson, Mich., plant. Manufacturing is done in cooperation with Hancock's electronics subsidiary, Computer Measurements Corp. of North Hollywood, Calif.

v v v

"Complete Reconditioning" of taps is the service offered by the newly formed Pioneer Tool Crib, Inc. of Farmingdale, N.Y. The restoration service is a combination of grinding and finishing operations plus expert judgment of exactly what is required to put a tap into first class operating condition. Staff of the new company is headed by Frank Cinelli, former production manager of S. W. Card Mfg. Co.

trade associations

At its recent meeting in New Orleans, the American Machine Tool Distributors' Assn. introduced its new slogan, "Our standard of living is made in America . . . on machine tools." Also, the organization is recommending that each member attach a new standard nameplate, identifying as "American Made", every domestic machine tool that he sells.

v v v

National Tool & Die Manufacturers Assn. have reported organization of new local tool and die associations in Boston and Rockford within the past few months.

new facilities

E. F. Houghton & Co. has completed new plant and laboratory facilities at Lumpkin Ave. and Detroit Terminal Railroad in Detroit. Facilities of the new Detroit Sales Div., which also has downtown offices in the Stephenson Bldg., include horizontal and vertical compounding and mixing, stainless steel tanks for chemical processing and modern control and testing facilities.

v v v

A complete manufacturing plant and research center for ultrasonics has been opened in Culver City, Calif. by Acoustica Associates, Inc. The plant, located at 11601 N. Jefferson Blvd. is the first western branch of the firm which has its headquarters near New York City.

v v v

U. S. Metal Coatings Co., Inc. has a new, larger and specially equipped plant at 224 Lincoln Blvd., Middlesex, N.J. The company has been located in Elizabeth, N.J. since its founding in 1935.

v v v

Ground has been broken for a new 11,400-sq ft research and development building at The Cleveland Crane &

Engineering Co. The new building, which is scheduled for completion in June, will include a modern engineering department and complete shop and testing facilities for assembling, handling and testing equipment under development.

v v v

The Yale & Towne Mfg. Co. has established a factory branch in San Diego. Calif. for sale and service of industrial lift trucks. The new facility is located at 6055 Fairmount Extension. Complete factory approved parts inventories will be maintained at the new branch, which also will maintain mobile service units to handle preventive maintenance and service repair work.

v v v

The 75th year of operation is being marked by Bound Brook Oil-Less Bearing Co. by beginning construction of a second ultra-modern plant at Sturgis, Mich. The new facility will be especially geared for high volume production of self-lubricated sintered bearings.

The modern building now under construction in Fair Lawn, N.J. is scheduled to replace entirely the present CIBA Co. Inc. Greenwich St. facilities in New York City. Because of the company emphasis upon new scientific developments stress has been placed on design and equipment of technical laboratories and related facilities.

competition

Research engineers less than 35 years of age are eligible for the F. W. Taylor Medal, recently created by the *College International pour L'Etude Scientifique des Techniques de Production Mechanique*—International Society for Production Engineering Research (CIRP). Applicants must present unpublished research papers dealing with some subject in the field of metals processing. Papers to be considered at the organization's next meeting, in September, should be submitted before the end of May 1958.

Interested engineers in this country should contact Prof. Milton C. Shaw of Massachusetts Institute of Technology; Mr. Eugene Merchant of Cincinnati Milling Machine Co.; Prof. Amos J. Shaler, The Pennsylvania State University; or Dr. G. Sachs, Syracuse University.

research

A $150,000, thousand-ton capacity press for research and development work on metals has been installed at Armour Research Foundation of Illinois Institute of Technology. The press, built especially for the Foundation by Hydraulic Press Mfg. Co., will be used to fabricate certain metals by extrusion, and will enable metals researchers to work with alloys that cannot be shaped by rolling or hammer forging. Among such alloys are those used in nuclear power engines, jet engines, misslies and atomic power reactors. The press also can be used in fabricating die materials for forming thin alloy sections needed in aircraft components.

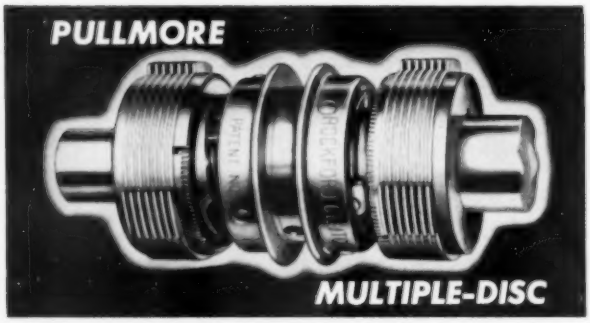
v v v

Opening of a research laboratory for investigation and testing of new developments for the die casting industry has been announced by B&T Machinery Co. The new facility, which provides 6,000 sq ft of floor space, is equipped with complete vacuum apparatus for vacuum casting of both zinc and aluminum.

v v v

New laboratory and research facilities which will be devoted to new methods and product development as well as development and refinement of manufacturing equipment and manufacturing

ROCKFORD



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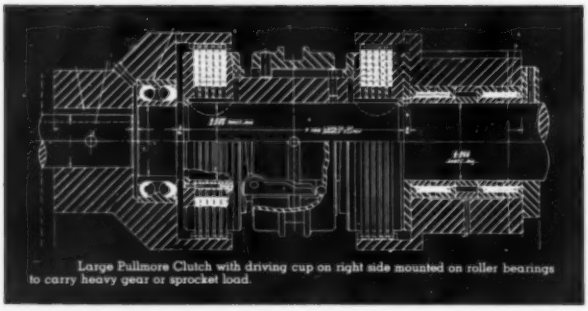
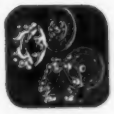

Large Pullmore Clutch with driving cup on right side mounted on roller bearings to carry heavy gear or sprocket load.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CLUTCHES

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techniques have been completed for Milford Rivet & Machine Co. The building is equipped with complete toolroom facilities as well as a range of standard production cold headers and secondary machines for experimental and development work. Fred H. Merwin, who has been president of Milford Rivet & Machine since founding the company in 1929, now has become chairman of the board and will be in charge of the Research Laboratory.

name changes

Name of Bendix-Skinner Div. of Bendix Aviation Corp. has been changed to Bendix Filter Div. According to company explanation, the new division name will be more descriptive of the wide range of products now being made by the company. The division's West Coast Poroloy Equipment, Inc. plant now will be called the West Coast Branch of Bendix Filter Div.

v v v

Vulcan Crucible Steel Div. of H. K. Porter Co., Inc. now will be known as the Vulcan-Kidd Steel Div. The Kidd Works which recently was acquired by Porter is located in Aliquippa, Pa. adjacent to the Vulcan Works.

acquisitions

Monsonto Chemical Co.'s Planishing Plate Div. has been purchased by Hawkridge Brothers Co. A segment of the production facilities of the division will be moved to a new plant in or near Boston area about June 1. Probably about the first of July the second line will be transferred to the new plant.

v v v

All machinery, inventories and patents relating to diesel operations of Micromatic Hone Corp.'s Micro-Precision Div. in Evanston, Ill. have been sold to Allis-Chalmers Mfg. Co. Aircraft interests of Micro-Precision are not affected by the sale according to Micromatic president Don S. Conner. He announced that this phase of the activity, including manufacture of Fabroid Teflon material, is being transferred to the company's Los Angeles division. Micromatic will retain the Micro-Precision plant and real property in Evanston pending suitable disposition.

new activities

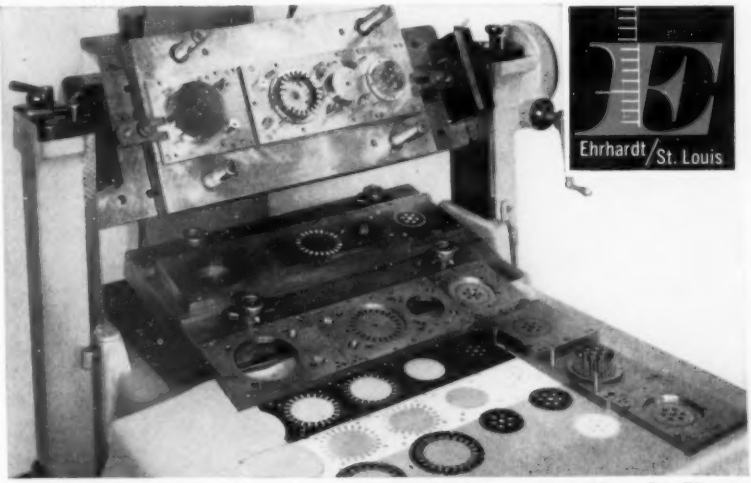
An impregnation equipment leasing plan that permits producers and users of castings to "try before they buy" has been set up by Prenco Mfg. Corp. According to company president, John W. Brophy, the plan is designed for castings producers or users who feel that production quantity is not sufficient to justify a capital outlay for impregnation equipment. All types of the equipment are available under the plan including special units designed and custom built to suit special needs of an unusual casting.

v v v

A new gage department has been set up by Size Control Co. for manufacture of special gages and precision parts in limited or production quantities. According to E. E. Olds, general sales manager, the department can make special gages to exact customer specifications or will submit designs for approval for special applications, including automation.

v v v

A newly acquired patented English process for continuous casting of copper alloys has been put into operation by Riverside-Alloy Metal Div. of H. K. Porter Co., Inc. Negotiations for the process, which is covered by patents and patent applications in both the



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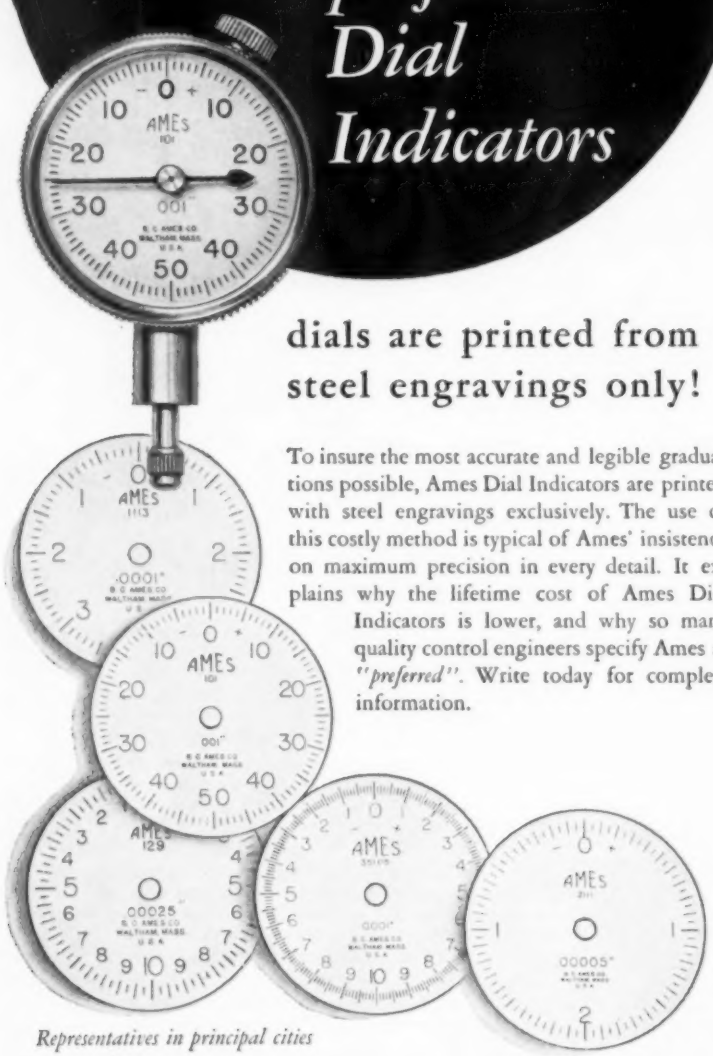

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United States and Europe, were completed with the English principals last year. The technique involves controlled pouring of molten metal and controlled solidification rates.

v v v

In line with a new concept in steel-plate merchandising, Lukens Steel Co. is providing a single source of supply for both plate and welding electrodes used in plate fabrication. Beginning July 1, the company will accept orders through its Chicago and Coatesville district sales offices for a complete range of alloy and mild steel electrodes.

new offices

Jones & Laughlin Steel Corp. has established a sales department sub office at 333 W. First St. in Dayton, Ohio to provide improved service in that area.

v v v

An office to serve the Detroit and Michigan areas with direct sales and stocks has been opened by Miniature Precision Bearings, Inc. at 21013 Mack Ave., Grosse Pointe Woods, a suburb of Detroit.

v v v

Work is under way on a new Los Angeles Branch office for Standard Tool Co. The building, located at 1001 S. Goodrich Blvd., is expected to be ready for occupancy in May.

corporate changes

Two divisions of Parker-Hannifin Corp. which have specialized in manufacture and sale of rubber and metal seals for fluid systems are being united in a single major organization to improve technical and sales attention. Name of the new division, which combines present operations of Parker Rubber and Franklin C. Wolfe Divs., will be Parker Seal Co., Div. of Parker-Hannifin Corp.

v v v

Organization of a Refractomet Div. has been accomplished by Universal-Cyclops Steel Corp. to advance company participation in commercial development of refractory and reactive metals. Headquarters of the division have been established at Bridgeville, Pa.

v v v

General Electric's Instrument Dept. has formed a fully integrated product section which will be known as the industrial instrumentation section. The newly formed section offers instrumentation products and systems for electric utilities, nuclear installations, equipment manufacturers and industry in general.

technical Shorts

Develop Alloy With Extra Bearing Strength

ALLOY X385, an aluminum die casting alloy, has built-in structural and bearing strength. It will withstand loads of 1500 psi. The alloy, which is the result of a three-year study by Alcoa Research Laboratories, is expected to find use where it is advantageous to provide integral bearing surfaces instead of cast-in or specially assembled bearings or bushings.

First commercial application of the alloy is in connecting rods for air-conditioning compressors. Further heavy bearing applications appear to be connecting rods for refrigerator compressors, electrical hand tool parts and mechanical appliances.

Tin, lead and cadmium in the alloy provide a combination of good casting characteristics, mechanical properties and bearing qualities. These elements also improve machining characteristics as compared to those of many aluminum alloys for heavy bearing applications which have shown poor castability and strength in die casting. Tensile strength and yield strength on a typical specimen are 36,000 and 20,000 psi, respectively.

• • •

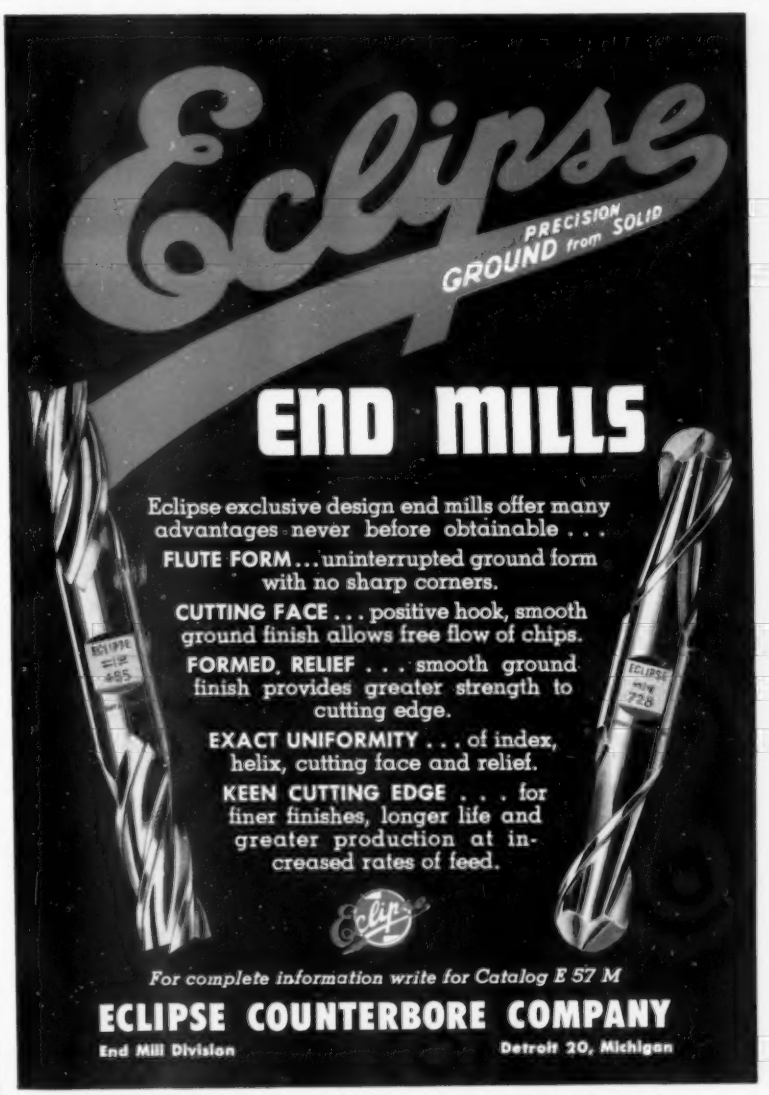
Nickel Material Gives Protection From Abrasion

UNUSUALLY high resistance to abrasion and impact has been "built-in" to a new extremely hard, yet flexible material developed recently by Metachemical Processes Ltd. of Crawley, England. Electroforms of this new material, called Micrograin nickel, currently are being used on leading edges of aircraft propellers as a guard to the delicate deicer elements against rupture due to impact with hail or stones during landing or take-off.

According to studies conducted by H. Denis Hughes and R. W. Lewis, superior properties of the nickel electroform stem from the very fine grain size deposited electrolytically. Although a standard nickel sulfate bath at conventional pH and temperature is used (without organic additives) grain size is so minute that no method of etching the deposit for micrographic analysis has been found. Discoverers of the process have established that the fine grain is due to the characteristics of the electrically conductive plastic sheet on which the nickel is deposited.

To make a Micrograin nickel electroform, a master mandrel of metal is cast to exact contours of the surface to be protected. An electrically conductive plastic coating several mil thick is then applied. After a flash coating of copper has been deposited, the unit is immersed in the nickel plating solution, where it remains until the desired thickness has built up.

Further identifying the resultant nickel as a different type is the finished electroform under compressive stress, as opposed to tensile stress. Its Brinell hardness is up to 600; however, it may be bent easily without danger of cracking. Shapes with re-entrant surfaces thus may be plated on the mandrel, removed, then closely fitted to the finished product.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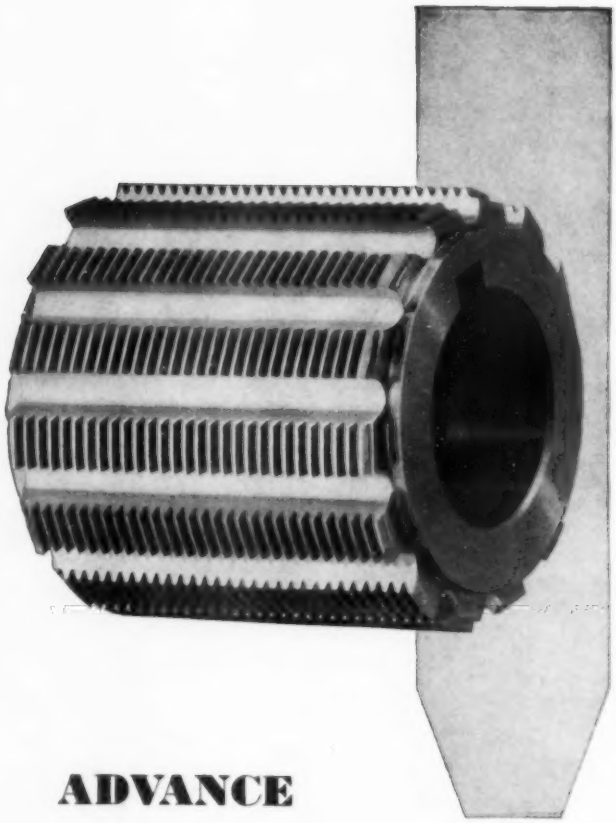

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TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer

Ceramic Tools

A survey of ceramic tools for machining steel and cast iron is given in an article by H. Opitz and H. Siebel published in *Werkstattstechnik und Maschinenbau* Jan., 1958, entitled "*Oxydkeramische Werkzeuge für die spanende Fertigung.*"

The main advantage of ceramics for machining steel was found in the decrease of crater formation and wear of the tool face in comparison with carbide tools. The authors state, however, that the quality of ceramic tools varies considerably. Some are far superior to carbides while others do not perform any better. In a number of cases, ceramic tools had even a shorter tool life than carbides.

Ceramic tools perform particularly well when used for machining cast iron rather than steel. In many cases, it was possible to increase the cutting speed three or four fold without reducing tool life. The hard scale on cast iron can be machined satisfactorily with ceramics.

The wear of ceramic tools is often greater than that of carbide tools during the first minutes of cutting; this wear ratio changes when the cutting is continued because the rate of wear for ceramics is less than that for carbides. In the authors' opinion, it is evident that ceramics will not replace carbides but that a field of application for ceramics will develop where carbides could not compete.

Ceramics are often less expensive than carbides when taking the total cost of a machining operation into consideration. The well-known relationship between cost and cutting speed can be represented by a parabolic curve, indicating that costs drop rapidly with increase in speed and increase sharply when the most economical speed is exceeded. This type of curve does not exist in the case of ceramics. The costs drop sharply with increasing speed but

do not rise again when passing the minimum cost point. This point lies at about 100 to 120 fpm for carbides and 400 fpm for ceramics. Doubling the cutting speed of carbides increases the cost by about 30 percent, but only insignificantly in the case of ceramics.

Ceramic Cutting Tools—Eastern Europe

The development of ceramic tools, particularly in Eastern Europe and Eastern Germany, are reviewed by A. Richter in *Fertigungstechnik*, Vol. 7, No. 11. The wear, tool life and surface finish obtained is discussed when machining various materials at changing cutting speeds. The effect of clamping the ceramic tool bits is described. The title of the article is "*Der gegenwärtige Stand in der Anwendung der Schneidkeramik.*"

New Experiences with Carbide Cutters

Soviet experiments with carbide milling cutters have been checked and repeated in West Germany according to a report by A. Grossmann in *VDI Zeitschrift*, Vol. 99, No. 15. Tool life can be increased three-fold according to this report by increasing the clearance angle.

Electrical Measuring Instruments

A great variety of electrical measuring instruments are described in an article published in *Werkstattstechnik und Maschinenbau*, Jan., 1958, by G. Beck entitled "*Elektrische Mess-und Steuergeraete auf der 5ten Europaeischen Werkzeng-Maschinen Ausstellung.*" Measuring tools are described such as the accuracy tester, indicating work dimensions at four places simultaneously.

Turning or Grinding of Rolls

Two Swedish authors have published an article in *Stahl und Eisen*, Jan., 1958, on the advantages and disadvantages of turning and grinding of rolls for wire rolling. T. Palm's article deals with an investigation of the life of rolls, either turned or ground, while H. Warrol's contribution refers to the economical aspect of the problem. The article is "*Gegenüberstellung der Vor- und Nachteile des Drehens und des Schleifens der Kaliber in den Walzen von Drahtstrassen.*"

A Talysurf tester was used in the investigation of the microgeometric condition of the surface of the rolls, magnifying the roughness between 2000 and 10,000 diameter. The authors found little difference (about 0.0002 in.) in the surface of the turned and ground rolls after production of 15 to 65 tons of material. Initially, the surface finish

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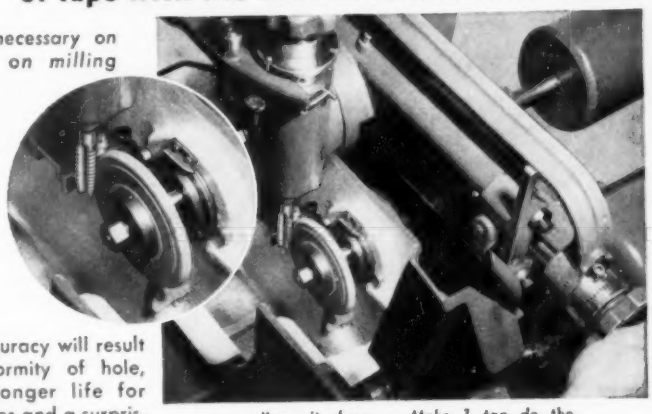

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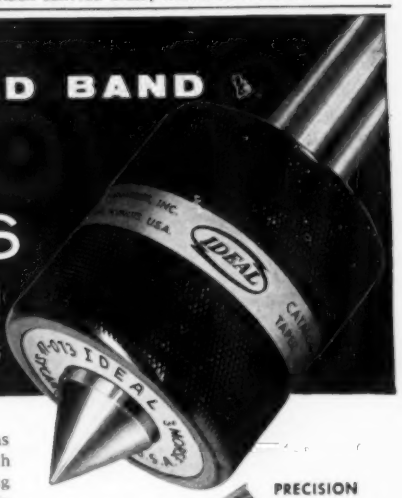

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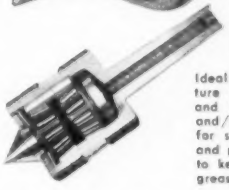

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of the ground rolls was better than that of the turned rolls but the advantage of grinding disappeared after rolling about 2 tons of material.

The conclusions are different, however, when the cost of turning or regrinding are taken into consideration. Grinding removes much less material from the worn roll than turning. The authors show that, ultimately grinding is less expensive than turning. This applies particularly to hard rolls where the grinding costs are less than turning costs, taking into account the life of the rolls and the frequency of reconditioning.

Grinding Research

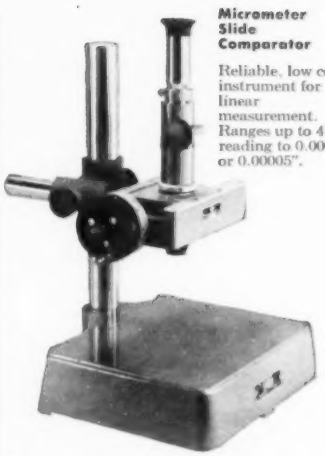
It is relatively more difficult to analyze the grinding process than any other metal-cutting operation according to a doctor's thesis published by *Janez Peklenik* and approved by the Engineering College of the University of Aachen under the title, "*Ermittlung der geometrischen und physikalischen Kenngröben für die Grundlagenforschung des Schleifens.*" Because classical mechanisms of grinding and of the wear, forces and temperatures lose their validity, the author uses statistical methods.

A new formula was developed for the chip thickness and an extension of the calculation of the length of engagement which is valid for all grinding operations.

The area of the wear surfaces of the grains has been used as a reliable and measurable quantity for determining the grinding wheel wear. A basis was established for the determination of the distribution of grinding forces and for the specific cutting force and metal-cutting efficiency.

The thermodynamic methods used in the past for grinding analyses have been replaced by a heat theory. The author determined that the temperature field is composed of many individual heat sources (grains) moving rapidly across the plane of engagement. This permits determination of the heat contribution by the various sources. A method has thus been developed for a reliable determination of the modulus of elasticity of the binder in grinding wheels and for their hardness.

Ultimate production of 60-million optical glass blanks a year is the anticipated output of a new Chance-Pilkington factory in North Wales. The unusually clean atmosphere of the locality provides one of the necessities for high purity standards for the product. Blanks will range in weight from one ounce to one ton—the latter for lead glass radiation shields in atomic energy work. Large overseas sales are planned.



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Trade Literature

for free booklets and catalogs—use convenient request card, page 169

Milling Machine

Eight-page brochure provides descriptive data on AF-30 automatic planer milling machine; well illustrated with dimensional drawings and with photos to show important main features; includes dimensions and specifications. Olivetti Corp. of America, Machine Tool Div., 42-33 Northern Blvd., Long Island City, N. Y. **L-5-1**

Superfinishing

Extensively illustrated with photos and drawings, 44-page catalog, Form 1169-B, covers 15 models and three attachments for superfinishing; includes sections on automatic size control, engineering service available and floor plans for all models; illustrates and explains 34 different job applications. Gisholt Machine Co., Madison 10, Wis. **L-5-2**

Air Power

Details on a number of air power applications for industry are presented in booklet, "Examples in Air Power Automation." Mead Specialties Co., 4114 No. Knox Ave., Dept. TF-P-74, Chicago 41, Ill. **L-5-3**

Metal Forming Machine

Catalog No. V-187 describes Vertiform 4-slide machine for wire and metal forming; contains complete specifications on the machine and points main advantages of vertical 4-slide equipment; includes details on machine's design, standard and optional equipment. The A. H. Nilson Machine Co., Shelton, Conn. **L-5-4**

Vises

Company's new drill press vise as well as latest design improvements in MilOmatic air-hydraulic vise are discussed in detail in Catalog No. 691 emphasizing important details and advantages. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. **L-5-5**

Phosphating Compounds

Two folders, one on CrysCoat No. 89 iron phosphating compound and one on CrysCoat HC zinc phosphating compound, describe characteristics, uses, application technique and advantages of the compounds. Oakite Products, Inc., Dept. TE, 19 Rector St. New York 6, N. Y. **L-5-6**

Packing

Variety of packings, gaskets and seals and their materials of construction and uses discussed in 12-page packing handbook, #AD-162; contains detailed table listing effect of numerous gases, liquids and solvents on packing materials from metals including metals, fabrics, synthetics and leather. The Garlock Packing Co., 422 Main St., Palmyra, N. Y. **L-5-7**

Rust Prevention

Chart No. 158 serves as aid to contractors, packaging engineers, etc., who need a quick reference to qualified preservatives for either military or commercial use; lists various military specifications and conforming Nox-Rust products as well as descriptions of their properties and applications. Daubert Chemical Co., 333 N. Michigan Ave., Chicago 1, Ill. **L-5-8**

SHUR-LOCK ADJUSTABLE ADAPTERS — built to GMC, Ford, Chrysler, ASA standards. Concentricity .002" TIR 6" from nose.
SPINDLE EXTENSIONS— for fast, easy accurate adjustments, saves setup time. Micro nuts provide individual adjustment.
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DRIVERS— hardened ground, precision-built, concentricity within .002". Made to automotive, ASA standards. Also Turret Tool Holders.
BRACKET SPINDLE ASSEMBLIES—exclusive flat outer-end arm design permits adjusting without breakage. Precision machined, smooth, efficient operation.
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Every year more and more prominent manufacturers and machine tool builders are turning to Seibert for a part or all of their production holding tool needs. We like to believe it is because more people have come to know we take a great deal of pride and pains in producing top quality tools that will stand up and give long, trouble-free service. Whatever the reasons, it is a privilege to serve. Our expanded line of tools are precision-built to meet exacting tolerance requirements and are lot-produced for maximum economy. We think you will like our service, too. We suggest you write, wire, or phone for quotations today.
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New brochure describes our current line of adjustable adapters, drill and tap drivers, spindle assemblies, pinion drive shafts, etc.
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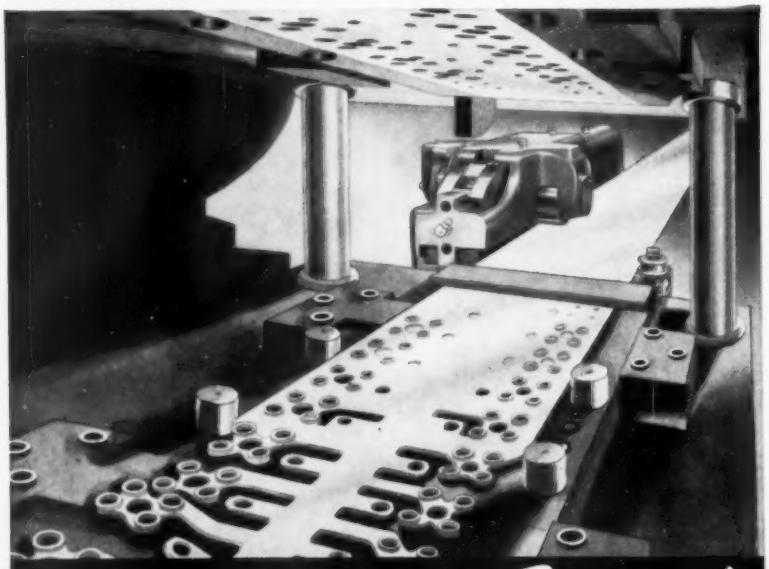
Formed Parts

Designed for product planning and production engineers, 28-page illustrated reference book, MME-P, lists all types, dimensions and durometers of grommets, bumpers, bushings, suction cups, caps, cylinder spring stock, packings, rods, rollers, sleeves, crutch tips, washers, extruded parts, laboratory stoppers, gaskets and miscellaneous parts. Aavilable to plant and purchasing executives. Engineering Dept., Miller Products Co., Inc., 29 Warren St., New York 7, N. Y. **L-5-9**

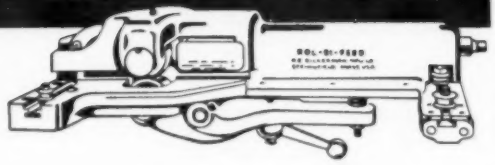
Drill Jig Bushings

Organized so that all technical data can be seen at a glance, folder-type catalog presents information on the broadened line of drill jig bushings; includes bushing types and sizes, drill sizes with decimal equivalents, concentricity of bushings and Rockwell hardness. Also available is a catalog cardsheet presenting similar information on drill jig bushings for plastic tooling. American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif. **L-5-10**

Dickerman Feeds *Present...*



A Press-Eye View of Precision!



Hour after hour, day after day, Dickerman Press Feeds feed more presses, for more production, more profits!

A standard "off-the-shelf" feed, at a fraction of the cost of special feeds, can solve the problem of speed, accuracy and dependability and pay for itself in days. Every one of the 14 models is press-room proved on thousands of different and unusual applications.

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Send for information on the complete Dickerman "standard" Press Feed line — experience unlimited versatility.

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Bearings

Full line of miniature ball bearings described in detail in 24-page brochure illustrated with photos, drawings and graphs; discusses applications and special features; separate section covers load ratings, limiting speeds and mounting procedures, as well as lubrication, handling and packaging. Dimensional code and torque conversion charts, plus charts and discussions on inspection correlation, clearances, tolerances and pre-selection also presented. Miniature Precision Bearings, Inc., Precision Park, Keene, N. H. **L-5-11**

Drilling Machine

Dimensional drawings emphasize important points of TMVO automatic multispindle drilling machine which is described in 8-page brochure; includes dimension and specification tables. Olivetti Corp. of America, Machine Tool Div., 42-33 Northern Blvd., Long Island City, N. Y. **L-5-12**

Alloy Tubing

Small diameter super-alloy tubing for applications requiring strength at high temperatures is described in Bulletin 70 extensively illustrated with graphs and charts; gives chemical composition, physical and mechanical properties and production limits for 16 super alloys in the line. Superior Tube Co., 1732 Germantown Ave., Norristown, Pa. **L-5-13**

Hydraulic Industrial Trucks

Complete check list to help maintenance personnel keep hydraulic system of industrial trucks in top condition; itemized by type of problem, suggests the causes to look for, and outlines the proper remedies. The Elwell-Parker Electric Co., 4544 St. Clair Ave., Cleveland 3, Ohio. **L-5-14**

Blast Cleaning

Twenty-eight page handbook, Catalog No. 143-D, on blast cleaning, finishing and shot peening ideas utilizing airless abrasive blast method, discusses versatility of applications of equipment; includes more than 50 case history accounts; describes specific types of company's machines, their applications, features and specifications. Wheelabrator Corp., 1182 S. Byrkit St., Mishawaka, Ind. **L-5-15**

Saw Blade Tensioning

Blade tensioning chart gives correct torque wrench readings in inch-pounds for different machine and blade combinations, and also shows the Counted Turn method for accomplishing accurate and precise tensioning. The E. H. Wachs Co., 1527 N. Dayton St., Chicago 22, Ill. **L-5-16**

Gaging

Good gaging practices, involving plain and thread plug and ring gages, are fully described in 16-page Gage Primer; covers work and gage tolerances, wear allowances, gaging policies, standard gage dimensions and gage pricing. Rite-O Tool & Gage Co., 321 W. Ten Mile Rd., Hazel Park, Mich. **L-5-17**

Gun Drilling

Detailed treatise on "Modern Gun Drilling Techniques" is based on extensive field studies of gun drilling production operations plus findings of company's research department; diagrams and charts explain principles, advantages and limitations of technique; also give specifications of typical grinds for use on various materials as well as regrinding directions. Madison Industries, Inc., Muskegon, Mich. **L-5-18**

Liquid Batch Mixing

Dial-type slide rule Capaci-Dial selector automatically tells the best Pneumix agitator for each liquid batch mixing problem; size of batches to be mixed is matched automatically to the proper consistency of fluid, amount of agitation desired and right agitator. Eclipse Air Brush Co., 390 Park Ave., Newark 7, N. J. **L-5-19**

Resistance Welding

Vol 5, No. 2 of 12-page "Resistance Welding at Work" describes seven resistance welding case histories which point out production advantages obtained through company's three-phase resistance welding techniques. Sciaky Bros., Inc., 4915 W. 67th St., Chicago, Ill. **L-5-20**

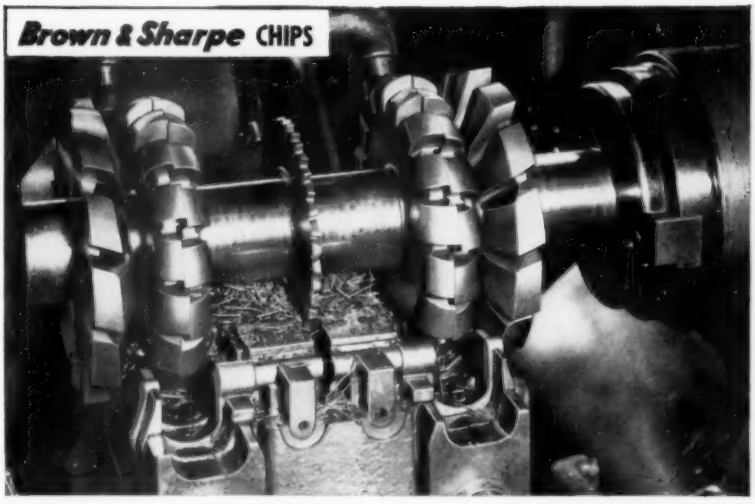
Machine Tools

Entire line of milling, grinding and screw machines covered in 36-page illustrated Catalog MT2; includes discussions of various optional mechanisms and additional equipment available for the machines. Brown & Sharpe Mfg. Co., Providence, R. I. **L-5-21**

Lubricants

Reprint of talk on "Choose Your Press Drawing Lubricants With Care," given by Leon Salz at the annual meeting of American Society of Lubrication Engineers presented in 8-page brochure; covers components of drawing lubricants and gives complete classification of press drawing compositions; recommendation chart shows required lubricant for stamping and shallow and deep drawing of carbon, alloy and stainless steels, aluminum, copper, brass and bronze. Magnus Chemical Co., Inc., Garwood, N. J. **L-5-22**

Brown & Sharpe CHIPS



Gang Cutters perform 5 Milling Cuts in 48 Seconds!

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Precision B&S Cutters Produce Precision B&S Micrometer Frames

Shearing action designed into these special Brown & Sharpe cutters gives a smooth, accurate finish on tough steel micrometer frame forgings.

Uniformity of product is vital . . . and positive, close tolerance milling is accomplished through experienced cutter development to produce fine surface finishes with no overheating, no piece distortion.

Angular-gash design of the outside form-relieved cutters quickly, precisely and economically mill outside contour. Two pairs of interlocked form-cutters (second from end) give smooth micrometer throat surface finish without chatter or scoring.

Even the cutter chips indicate the degree of precision built into B & S PRODUCTIONEERED cutters.

Call on the local Brown & Sharpe Cutter Engineer to trouble-shoot your production problems.

Write for 96 page Catalog 37C showing over 2500 High Speed Steel Tools and Accessories to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

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PRECISION TOOLS AND GAGES • MILLING GRINDING AND SCREW MACHINES
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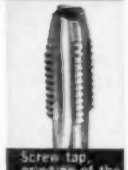
new, revolutionary ALINA SELECT-O-POINT drill grinders

Right hand twist drill, with centre

Twist drill for soft material, tips corrected

Three-flute drill (core drill)

Spot facing cutter, countersink angle 60°


Screw tap, grinding of the angle of rake

Designed for rapid and accurate grinding of:
Keyway Milling Cutters • End Mills
Spot Facing Cutters • Screw Taps
Twist Drills • Step Drills • Reamers, etc.

Three models to choose from — *No. 01-2 Range .004" thru .080"—No. 03-6 Range .012" thru .240"—No. 2-32 Range .093" thru 1.250"*. Each machine is a complete system built around a *planned drill point*. Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated *exactly* at any time. Accuracy and simplicity is built into each machine.

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Cold Forming

Eight-page "Lubrication Newsletter" No. 304 features lubrication tips for cold forming operation; discusses economical methods of application and removal, outlines drawing lubricant requirements, and offers typical example of use of lubricants in punching operations. The Alpha-Molykote Corp., Stamford, Conn. **L-5-23**

Grinding

Extensively illustrated to point out main features and advantages of machines. 24-page Catalog I-57 describes 10-in. Type H universal grinders; gives complete specifications and outlines standard and extra equipment. Landis Tool Co., Waynesboro, Pa. **L-5-24**

Tool Making Machine

Illustrated 8-page brochure covers applications in extrusion dies, tungsten carbides, carbide form cutting tools and other types of tools and dies of the Roto Recipro toolmaking machine. Connecticut Tool & Engineering Co., Round Hill Rd., Fairfield, Conn. **L-5-26**

Chucks

Full line of electromagnetic, permanent magnetic and vacuum chucks, demagnetizers, chuck control equipment described in detail in well illustrated 20-page Catalog No. 58; includes specifications. O. S. Walker Co., Inc., Worcester 6, Mass. **L-5-27**

Flame Cutting

Line of Oxweld flame cutting machines described in 28-page catalog, Form 4487; includes specifications for each machine, illustrations of typical installations, and descriptions of machine accessories. Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y. **L-5-28**

Tool Lapping

Technique of finishing and refinishing carbide cutting tools and inserts, based on use of Hyprez Diamond Compounds, described and illustrated in booklet stressing advantages of method. Hyprez Div., Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **L-5-29**

Drives

Catalog 100 gives latest information with pertinent charts and data on stock gears, speed reducers, sprockets and chains, flexible couplings, universal joints, collars and pillow blocks; selection chart simplifies selection of speed reducers and stock gears. Each section of 80-page brochure is color coded for easy reference. Charles Bond Co., Gear Div., 617-23 Arch St., Philadelphia 6, Pa. **L-5-30**

who's meeting and where

May 1-8. American Society of Tool Engineers. 26th annual meeting and 1958 Tool Show. Bellevue Stratford, Sheraton and Benjamin Franklin Hotels and the Philadelphia Convention Center. For details, contact Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

May 3-6. National Tool & Die Manufacturers Association. 11th spring meeting, Statler Hotel, Washington, D.C. For details, contact association office, 907 Public Square Bldg., Cleveland 13, Ohio.

May 5-9. American Society of Training Directors. 14th annual conference, Sheraton-Park Hotel, Washington, D.C. Get data from ASTD, P. O. Box 958, Washington 4, D.C.

May 8-9. Illinois Institute of Technology. Cost reduction conference, Metallurgical and Chemical Engineering Bldg., 10 W. 33rd St., Chicago, Ill. Get details from LeRoy A. Wickstrom, Illinois Institute of Technology, Chicago 16, Ill.

May 8-10. American Material Handling Society. Western regional material handling show, Great Western Exhibit Center, Los Angeles, Calif. Contact show offices, 2807 Sunset Blvd., Los Angeles 26, Calif. for more data.

May 11-13. Fluid Controls Institute, Inc. Spring meeting, Lake Placid Club, N.Y. For complete data, write to R. McCormick, chairman, Public Relations Committee, Fluid Controls Institute, c/o Automatic Switch Co., Florham Park, N.J.

May 26-30. American Management Association. National Packaging Exposition, Coliseum, New York City, and National packaging conference, Hotel Statler, New York City. For details, write AMA Press Relations Dept., 1515 Broadway, Times Square, New York 36, N.Y.

May 27-28. Electronic Industries Association. Conference on maintainability of electronic equipment, University of Pennsylvania, Philadelphia, Pa. Request additional information from EIA engineering office, Room 650, 11 W. 42nd St., New York 36, N.Y.

June 8-13. Society of Automotive Engineers. Summer meeting, Chalfonte-Haddon Hall, Atlantic City, N.J. For details write society office, 485 Lexington Ave., New York 17, N.Y.

June 8-13. Pennsylvania State University. Industrial training clinic conducted in cooperation with the American Society for Training Directors. Write to Prof. Ray S. Farwell, Extension Conference Center, The Pennsylvania State University, University Park, Pa.

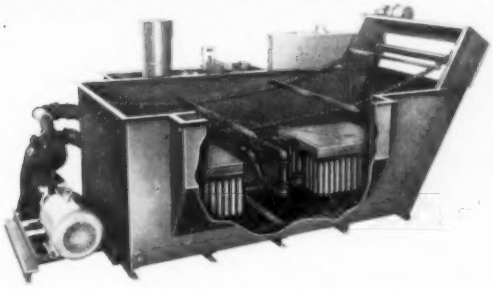
June 9-12. Materials Handling Conference. Public Auditorium, Cleveland, Ohio, sponsored by American Society of Mechanical Engineers, to be held concurrently with National Materials Handling Exposition. Send inquiries to Exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

June 9-13. The Pennsylvania State University. Automation seminar. For complete information, write to Engineering Seminars, Extension Conference Center, The Pennsylvania State University, University Park, Pa.

June 12-14. American Institute of Industrial Engineers. Ninth annual national conference and convention, Hotel Statler, Los Angeles, Calif. Get further information from the institute, P.O. Box 22069, Los Angeles 22, Calif.

For Super Finishes at Less Cost

Delpark **Dual Manifold, Vacuum Filter-Matic Filter**



Dual Manifold Tubular Screen Filter shown.

Leaf Type Filter Elements also available.

SUPER finishes no longer carry a high cost per unit. The reason is the high efficiency filtering action of the Delpark Dual Manifold Filter-Matic.

1. The rejection rate is greatly reduced.
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4. Filter servicing is no longer required.

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Best in the long run
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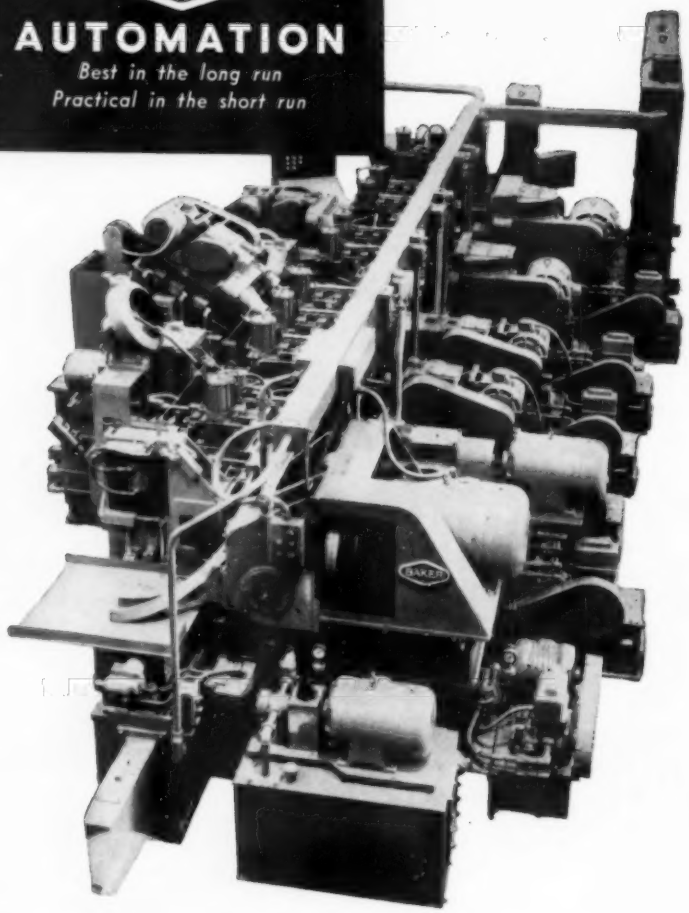

THIS BAKER SPECIAL

ups production to 75 main bearing cap assemblies per hour.

Operations are: drill, ream, mill, tap, assemble dowels, and separate — all automatic.

OLD TIMERS' CORNER

Remember when Baker made nothing but gear-feed drilling machines? Quite a contrast with modern Baker specials — the bulk of Baker output today.

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☐ Baker Specials . . ☐ Baker *standard* machines.

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COMPANY

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good READING

TOOLING FOR METAL POWDER PARTS—*By George H. DeGroat. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price: Members, $6.00; nonmembers, $7.50. 253 pages.*

With publication of this book, ASTE deviates from its past practice of producing reference books written by many men of industry. Written by one author in a handbook-textbook style, it is a comprehensive treatment of powder metal industry knowledge, which was previously not available in this consolidated form. The information will be useful to all levels of management—executives, tool engineers, product designers and line production personnel. It fills the gap usually found between the general descriptions of the process and the extremely technical metallurgical aspects.

Process planning, economics and tool design data are sufficiently detailed to help engineers obtain a better understanding of the process and its applications. To organizations contemplating use of powder metal parts, the information will help management decide on types of materials, process steps and equipment requirements.

The section on design of structural parts will prove useful to design and manufacturing engineers. How design can decrease the cost and simplify manufacture is discussed in detail. Often, a minor change in the location of a parting line, coring or part section thickness will reduce or remove machining requirements, reduce press time or both. Probable tolerances that can be expected in various stages of manufacture, as well as physical properties, are included to help the designer and process engineer.

Production methods for the manufacture of powders used in the process and the typical powder output are described for most of the materials currently in use. The methods, e.g., atomization and pulverization, chemical reduction, electrochemical precipitation, are given extensive treatment including tables for the selection of processes for

specific materials. Testing methods and standards, effect of chemical impurities and chemical analysis, as well as conditioning and blending practices are part of this section on powders.

Relative to briquetting and sintering practices, these sections include information on presses, tooling and furnace equipment needed to adequately apply the process. The briquetting section has applications found in user plants, die construction and discussion of European practices. An example of how this book treats practical shop information can be found in the description for making irregularly shaped punches to include a broach for finishing the die. Temperatures for sintering the various materials and the relative costs of different sintering atmospheres make this book an important asset to anyone using the process.

Of equal importance is the section on finishing methods. Sizing, coining, burnishing and machining including the tool geometry are covered as well as space would permit in a book on a specific process. Surface cleaning, impregnation and infiltration, plating practices and heat treatment for powder metal parts are other subject included as part of this complete discussion.

The final two sections of the book are devoted to standard definitions used in the industry and an extensive list of references and bibliography.

BARON, CALCIUM, COLUMBIUM, AND ZIRCONIUM IN IRON AND STEEL—*By R. A. Grange, F. J. Shortsleeve, D. C. Hilty, W. O. Binder, G. T. Motock and C. M. Offenhauer. Published by John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $14.00. 533 pages.*

This book is the fourth in a series of monographs on alloys of iron offering a comprehensive collection of heretofore scattered research data. Each alloying element mentioned in the title is treated in a separate section. Phase equilibrium diagrams are presented along with fundamental metallurgical aspects of each metal. The discussion extends effects of the alloying elements on mechanical properties and heat treatment.

The book and its extensive bibliographies ease the burden of research placed on the engineer and metallurgist by making available accurate information in a clear and concise form.

HANDBOOK OF LAYOUT AND DIMENSIONING FOR PRODUCTION—*By Hyman H. Katz. Published by The MacMillan Co., 60 5th Ave., New York 11, N. Y. Price $15.00. 488 pages.*

This book was created especially for dratfsmen to give them an over-all picture of layout, detail design and production dimensioning practices in the metalworking industries.

Recognizing that the key element of a draftsman's development is his experience at the drawing board, the author does not propose this book as a substitute for practical experience. Through the use of this handbook the draftsman can learn the necessary steps in creative design and how he can apply these steps to his own work.

The author's background in education and his years of top-level industrial experience make him an authority who knows what must be taught and how to teach it. Writing clearly, organizing his material systematically and referring constantly to the most exacting industrial standards, he offers a book which is as valuable a reference for the skilled draftsman and designer as it is a basic text and guide for the beginner.

METHODS FOR EMISSION SPECTROCHEMICAL ANALYSIS—*Sponsored by ASTM Committee E-Z on Emission Spectroscopy. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price $5.25 to ASTM members, $7.00 to nonmembers. 504 pages.*

This compilation contains all spectrochemical practices and methods published by ASTM. The intention in publishing is to present the pertinent information for each method and practice to permit its application in various laboratories and with different types of equipment. The scope, limitations, precision and accuracy of the methods have been recorded to the extent of data available, in order that methods can better be compared and evaluated with respect to other analytical methods. Included in the appendix is an index of available material on the subject.

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ARMSTRONG
Carbide Insert
TOOL HOLDERS

See us at our BOOTH No. 308 ASTE SHOW

with proven
ARMSTRONG Design Features

Rapid Indexing—always easily accessible from top or bottom sides . . . reduces down time.

Replaceable Seat of Hardened Tool Steel—prevents damage to shank.

Huskier shanks of Heat Treated Alloy Steel—for added strength and rigidity.

Shank Styles for Use in both Conventional and Open Side Tool Posts.

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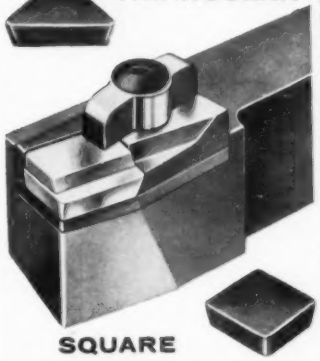
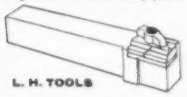


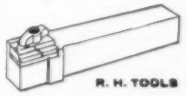
SQUARE

These positive rake Carbide Insert Tool Holders are for every day tool room and production turning on engine lathes, turret lathes and screw machines. They permit increased cutting speeds associated with the use of carbides and they entirely eliminate carbide tool grinding.

Low cost positive rake ARMIDE "throw away" Inserts provide three or four cutting edges per insert. Triangular inserts have three, square inserts four cutting edges. They are available in three grades of ARMIDE: 350, 370 or 883.

Buy positive and negative rake Carbide Insert Tool Holders which carry the ARMSTRONG trade mark; leader in tool holders and cutting tools for over sixty years.


L. H. TOOLS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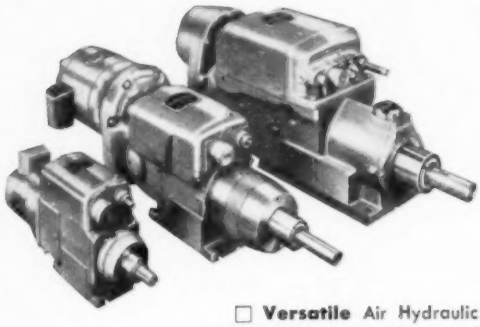
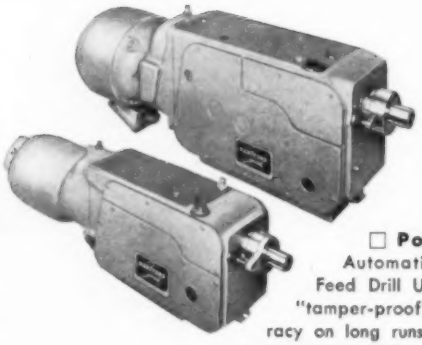
CAN CUT PRODUCT COSTS WITH HARTFORD POWER UNITS



☐ **Versatile** Air Hydraulic Drill Units for quick change of set-ups, rapid operation.



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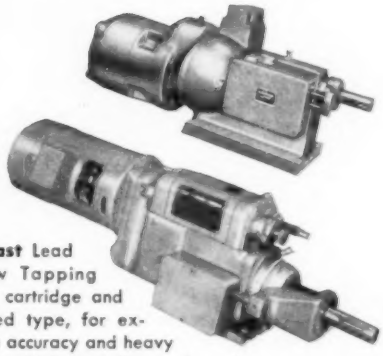

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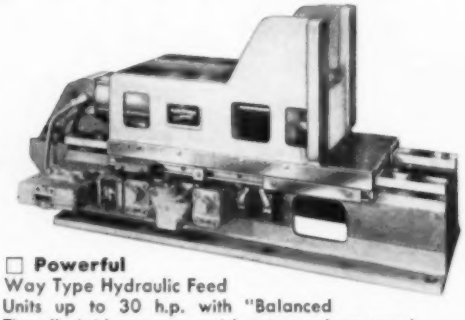

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Tech Digests

Sheet metal fabrication in the aircraft industry

By Adolph Vleek, Jr.
Manager
Manufacturing Engineering and Research
The Martin Co.
Baltimore Div.

Sheet metal fabrication in the aircraft industry departs from established sheet metal processing and planning techniques employed in other industries. Low-volume and short-production runs, *Fig.* 1, make it extremely difficult to economically amortize the more sophisticated type tooling; however, it is occasionally necessary to resort to this type to achieve interchangeability on certain airframe components. Aside from our austerity type tooling philosophy, many revolutionary developments, during the past few years, have contributed extensively toward improved quality and increased output at reduced cost.

When sheet metal was first adopted for airframe construction, no specialized processing machinery was available for this type work. It was necessary to improvise and to fabricate component parts of a structure or assembly in many bits and pieces.

One of the first significant departures from this costly and time-consuming approach was the introduction of sheet-metal stretch forming equipment making it possible to stretch wrap large sheet metal, and bent up and extruded details.

Another significant development, which contributed measurably to this advancement in sheet metal processing, was the Guerin trapped rubber forming system. The rubber head, which is confined in a round or rectangular steel frame, serves as a portion of a tool such as the lower half of a conventional die. Since only the punch portion of a conventional type die is required, all of the close tolerance machining normally associated with precision die manufacturing is eliminated, with savings in tool cost.

Efforts to minimize undesirable, hand-tailoring operations led to the development of Marform, a refinement of the Guerin process, having a hydraulically actuated pressure pad which controls the flow of material over the tool to produce finish formed parts that previously

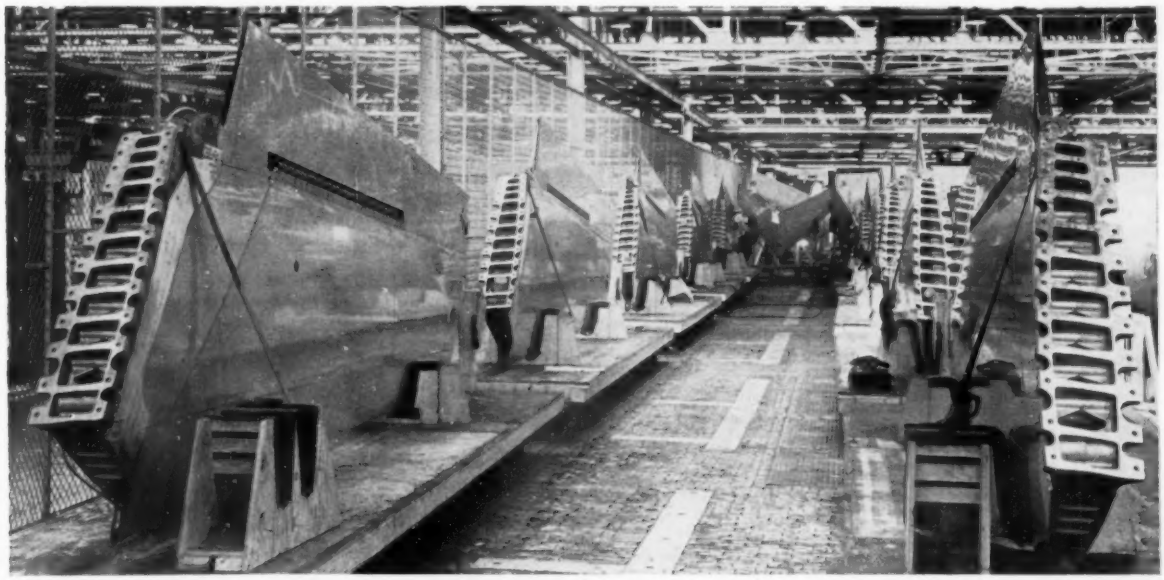

Fig. 1. Bonded honeycomb wings of Matador missle in special cradles awaiting movement to final assembly area.

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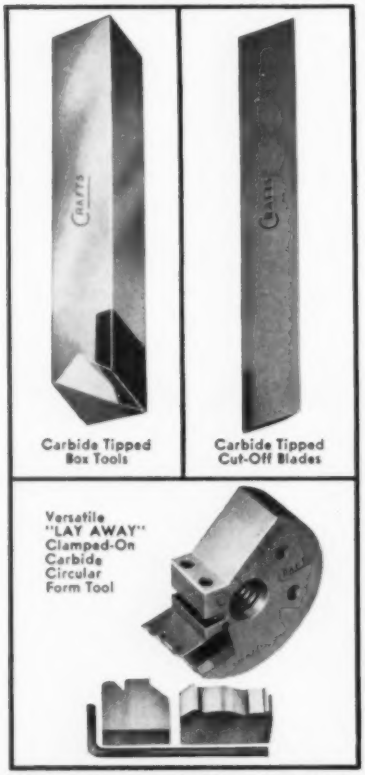

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Fig. 2. Sheet metal parts being quenched after heat treatment by the "Free Fall Quench" method.

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Although not new to the metal-forming industry, another forming technique, used quite extensively in the airframe industry, is a process known as bulge forming. This technique is particularly adaptable to large cylindrical or circular sections such as engine nacelles. There are several different versions of this forming method which employ hydraulically expanding dies, compressed rubber and explosives.

Other versatile machine tools used in airframe sheet-metal forming are slip rolls, brakes, mechanical presses, foot, hand and hydraulic shrinkers and stretchers. Metal spinning is being used to some extent; however, this process has been supplemented with a newly developed process known as flow turning and holds considerable promise for more extensive use in airframe sheet-metal fabrication. Tubing, which is also used extensively in our operations, is processed on standard type equipment for such operations as bending, flaring, swaging and beading. These same operations are performed on high-strength materials through the use of heated tools.

Many of the aforementioned operations must be performed today with the application of heat to the tools, machine tool and piece part. This elevated temperature forming and shaping of parts has been prompted by more recent designs which call for parts to be fabricated from the newer, high-strength materials such as titanium, zirconium and hot-work die steels in the 260,000 to 280,000 psi range.

Sheet-metal blanks are normally produced by routing and sawing. Where sufficient volume will justify more productive type tooling, the piece blank template type dies are used. On higher tensile materials, such as titanium and stainless-steel alloys, conventional punch and die sets and specially designed steel rule dies are needed.

Drilling operations are performed on parts stacked to various predetermined heights depending on material types and gages and drill runout allowances. Pilot holes are generally drilled from bushings located in adaptors attached to the spindle proper and piloted into bushingless templates. Matched and tooling holes are drilled from fixed bushings mounted in drill templates. The stack heights are limited on the latter to control drill runout and center to center hole tolerances. Stack heights must also be controlled when drilling titanium, stainless steel and other high tensile materials.

When severe contours, sharp bend radii, etc., are required, aluminum parts are produced from annealed material followed by a heat treat and time-consuming hand-finishing operation. All other aluminum sheet-metal parts are made from fully heat-treated material.

On the details requiring heat treat after forming we use both the oven and solution heat-treating processes. At Martin this work is accomplished by the salt bath or solution heat-treat method, however, the basket type quench which produced a considerable amount of distortion in the aluminum parts has been

Fig. 3. Layup of an all-steel honeycomb panel before brazing with surface lifted to show construction.

replaced by a more effective quenching system known as "Free Fall," *Fig.* 2. Instead of loading the parts in a basket and lowering same into the quenching medium, the parts are hung on hooks positioned on a rack. After removal of the parts from the salt bath, a quick release mechanism is tripped just above the quenching tank, thereby allowing the parts to fall quickly and freely into the quench. Elimination of the basket permits a faster, more uniform quench with relatively distortion free parts.

In the area of sheet metal joining, riveting and fusion welding have long been the accepted standard, but with the general acceptance of the high strength to weight ratio sandwich materials, adhesive bonding, brazing and "cold" welding are leaping into prominence. The intricate assembly of fusion welded or riveted structures, with its complex assembly fixturing, has been replaced to some extent by relatively simple, highly efficient and economically produced adhesive bonded honeycomb structures, *Fig.* 3.

Where vehicle operational temperatures are high, adhesive bonding is being replaced by brazed type structures, and while the brazing "state of the art" has not progressed to the degree of perfection currently enjoyed by bonding, it is anticipated that this gap will be narrowed rapidly.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Future models, presently in the predesign stages indicate that brazing is only an interim method of metal joining. In order to successfully produce these models it will be necessary to further develop and modify currently employed resistance welding techniques and equipment. One of the principal problems that must be overcome is the welding of thick cover skins to relatively thin core materials without increasing the notch sensitivity of high strength parent materials.

Most of the discussion so far has pertained to the production of the conventional or slower speed aircraft. Now let's take a brief look into the immediate future—the production of weapons systems that are destined for operation within the next five or ten years.

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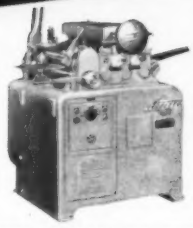

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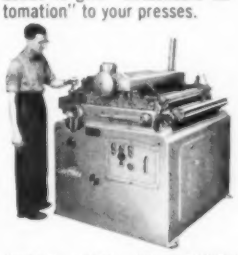

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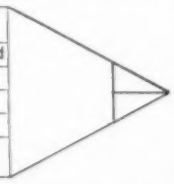

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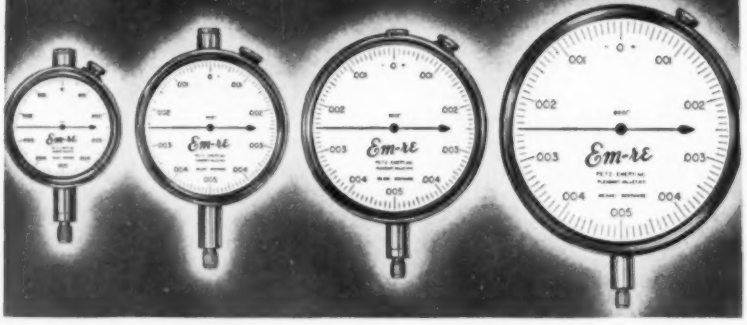

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cation business with a challenge equal to none in history. New exotic sheet materials destined for use in these vehicles, capable of retaining their full strength and antierosion type characteristics will require revolutionary changes in our sheet-metal processing methods. In many cases materials have not yet been developed that will withstand the severe operational conditions to which they will be subjected. Consequently, there is little or no processing know-how to rely on in converting them into usable end items. For this reason our industry is expending more effort than ever before in manufacturing research and development—an effort devoted almost exclusively to the resolution of these problems. Without reliable materials-processing technology, there is little likelihood that these high-performance vehicles will ever get beyond the drawing board.

From a paper presented at Newark, N.J. meeting of the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, March 1958.

▼ ▼ ▼

Future Possibilities of Automatic Programming

By Douglas T. Ross

Head, Computer Applications Group
Servomechanisms Laboratory
Massachusetts Institute of Technology
Cambridge 39, Mass.

In the past several years the importance of numerical control as a new production technique has been widely publicized. By controlling a physical process in response to numbers, numerical control provides a link between the growing field of data processing and the production of actual parts. It is now possible to use the artificial, mathematical records and computations of the design process for the creation of pilot or production models of complex parts.

In order to achieve some of the benefits of this new manufacturing technique, it is necessary to create a means for passing directly from the plans for a part in the mind of the designer to the detailed, numerical instructions which will cause the desired part to be produced. This is the goal of automatic programming, a new aspect of the technology which has recently come into being.

The possibilities of automatic programming are limited only by imagination and economics. Although the development of automatic programming

systems is indeed expensive, the potentialities have hardly been scratched and it is impossible to predict accurately the net cost of automatic programming once it is put to extensive use. It is a well known fact, however, that research and design which go into production parts are extremely expensive items, so that any automatic system which can take over even a portion of these functions has a good chance of paying its own way.

Any attempt to put into an automatic system some of the design functions now performed by highly skilled humans is immediately confronted with a number of very difficult problems. The mechanical and computational steps through which a design progresses are a fundamental problem, but existing techniques of numerical analysis and related topics, if diligently applied, can probably yield solutions.

A much more difficult problem, one which is unique to automatic programming systems, is that of determining the parameters and decisions from which a designer begins his design, and finding a way for him to express these quantities in a form which can be used to instruct the automatic programming system. It is not possible to build real intelligence into an automatic system so that it is necessary that the designer pass on to the system sufficient information for the automatic system to determine the necessary parameters.

This is the problem of language design, the problem of determining a vocabularly and rules for making statements to the automatic system which will convey the design problem in an unsolved but complete form, from the mind of the human to the computer system. Since this type of problem never arose before the advent of automatic programming systems, very little is known at the present time about this area and much research remains to be done.

Assuming steady progress in the development of automatic programming systems, it is not improbable that within the next decade or so it will be possible to obtain a sample part from a system having specified only a few structural dimensions and the various forces, stresses, and vibrations to which the part will be subjected with all of the intermediate steps of design and drafting, model making and testing essentially eliminated.

The problem of fairing between various surfaces will surely be one of the first road-blocks to fall and a number of related problem areas are currently being worked on in various places in industry. It is interesting to note that aerodynamics, hydrodynamics, and stress analysis are all subject to similar mathematical laws, the laws of streamlines, so that a breakthrough in any one of these areas could affect the other areas.

The members of industry should be patient when it comes to automatic programming. A common reaction is that the remarkable possibilities which automatic programming offers are so attractive that it is momentarily forgotten that this is still an infant technology and initial systems will necessarily have limited capabilities.

It is desirable that industry support this type of research through their own industrial organizations, so that the practical problems of production and design are covered adequately. Although the APT techniques which are currently being developed are for 3-dimensional contour milling, the concepts and ideas are applicable wherever numerical control is used. It is hoped that the presentation of these ideas will stimulate thinking and action in other parts of industry.

From a paper presented at the Third Annual Contour Machining Conference. True-Trace Corp., El Monte, Calif.

▼ ▼ ▼

Industrial Research and Development Today

By Lawrence R. Hafstad
Vice President in Charge of Research Staff, General Motors Corp.

There is a well-known game that psychologists play called word association which might be interesting to test out in connection with my subject today. I will simply ask the question, "What single word suggests itself to you first, when the idea, Industrial Research, is mentioned? I hate to disappoint my psychologist friends but in trying this out on myself I have to conclude first that my mind must be a fuzzy one for several words insist on coming to mind and not in any specific order either. However, two words seem to stand out. For me, these two are "growth" and "conferences." I might add "endless growth" and "endless conferences."

On reflecting upon our subject, many other ideas and problem areas suggest themselves. Closely associated with the growth idea is the idea of shortage of talented personnel. This, too, has been the subject of endless conferences and voluminous essays. Next the idea of disillusionment suggests itself to me. It has gradually become clear that there

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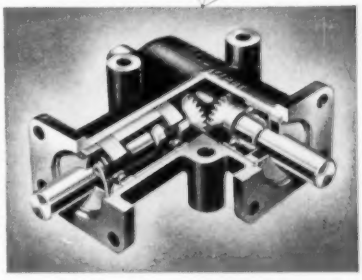

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are a certain number of problems in the world that can't be solved by scientific research. In the years since the war, industrial research has become sophisticated, both in technique and in philosophy. Cost of development looms as a particularly important problem area. Boards of directors do not necessarily expect always to catch large fish, but they do get chary about the process of continuously passing out bait.

Patents and patent protection represent another highly important problem area in the industrial research scene. The patent system was conceived as an incentive to inventors, but this incentive is to a large degree being eroded away. Here, in my opinion, a sharp distinction should be made between an "incentive to invent" and an "incentive to develop." Apparently few people are even aware of the difference.

A further chronic problem area in industrial research is the question of the relative proportion of long-range and short-range activities or basic vs. applied research, which I gather is of concern even in the Pentagon.

Finally, and probably most important of all, is the interaction between technology—that is the entire process of discovery, invention, development and production—and society itself. This raises the question of economics in regard to the basic operation of our industrial society. I am convinced that industrial research laboratories will from self defense be forced to begin developing a serious interest in economics.

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Research, both academic and industrial, has changed enormously since before the war. Research has changed quantitatively as is indicated by any of the usual indexes familiar to you all: the total annual cost, from a quarter of a billion to over six billion dollars; the number of people involved from one hundred thousand to almost six hundred thousand; the number of companies conducting research and development from about two thousand to over twenty thousand. Research has also changed qualitatively and this, though a more subtle change, may indeed be the more important.

Before the war, research (both aca-

demic and industrial) was carried out by small, intensely dedicated groups of people working in relative obscurity. In most cases very real personal sacrifices were required, which only a few "peculiar" individuals were prepared to make.

At that time, an engineer was clearly an engineer, and a scientist was clearly a scientist. During and since the war, this distinction has tended to disappear. Before the war there was a very sharp distinction between a fellowship and a salary. This seems to have evaporated completely.

In pondering the over-all problem of developments in industrial research in recent years, two things stand out. First, there is the almost unbelievably rapid growth which I have mentioned. Second, there is the growing economic importance of the brand-new products coming out of this research.

The exact ratio of basic to applied research cannot be fixed by formula. It will vary with the past history of the organization, the financial condition of the organization, and the competitive situation. However, since a corporation is itself one of society's mechanisms specifically designed to provide an incentive to develop new products, a general rule would be the following: As long as there are more novel ideas to exploit than the organization can digest effectively, the basic or exploratory type of activity need not be emphasized. When the novelty of ideas begins to slacken it is time for a campaign of basic research to provide new areas for advances.

A research program, however, cannot be turned on and off like a kitchen faucet. Although the time between discovery and application is growing short, we do not know how to reduce the time to make the research discovery. It takes time to build up a competent research organization and development program. Where competition is strong and breathing down one's neck, research must be a continuing activity. Research can only be depended upon to come up with a solution in a hurry when it has a backlog of fundamental knowledge provided by a continuing program. For this reason the prudent research director will maintain his basic research program at a level which in his judgment he can justify as a continuing long-term activity. This means that he may have to hold it down in periods of prosperity in order to be able to defend it effectively when money is tight.

From a paper delivered at the Industry-Navy Research and Development Conference, sponsored by the National Security Industrial Association, Washington, D.C.

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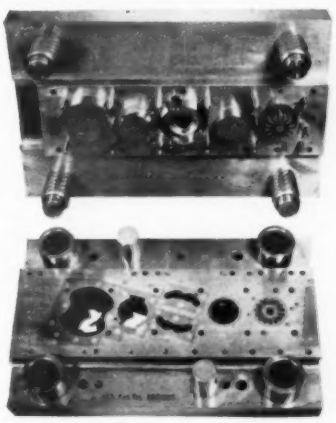

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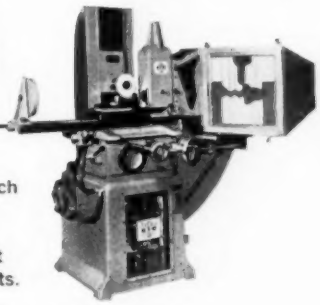

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DBL-2 is an improved general-purpose high speed steel. It contains tungsten, molybdenum and vanadium in such proportions that it excels 18-4-1 for most applications. DBL-2's unusual combination of high hardness with toughness, its ability to hold a fine grain over a wide hardening range, and the fact that it easily machines many diverse types of stock, made it particularly well suited for this job.

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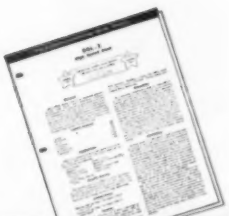
There is an A-L tool steel to meet your toughest requirements. For further information call your A-L representative or distributor today, or write . . . .
Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.



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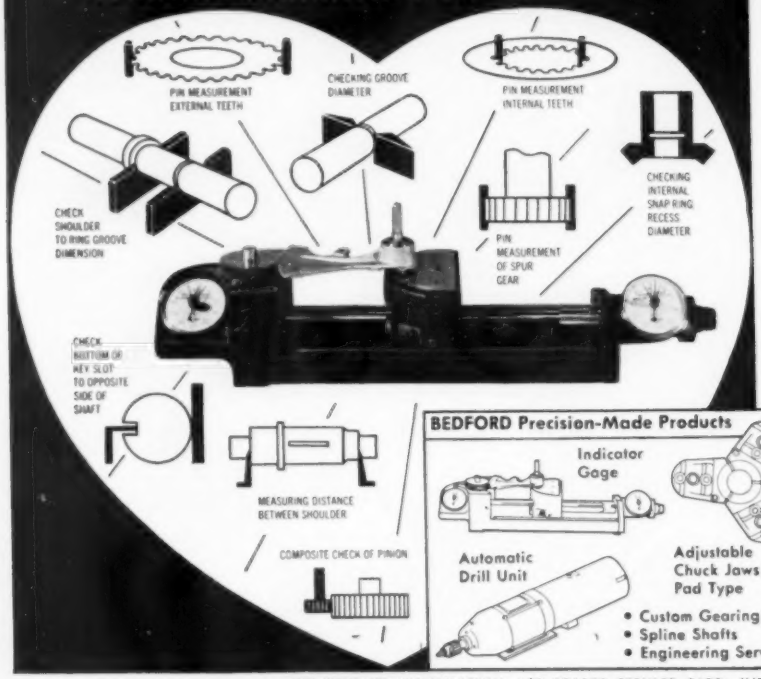
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CHECKING GROOVE DIAMETER
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CHECK SHOULDER TO RING GROOVE DIMENSION
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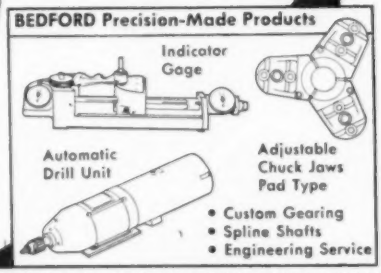

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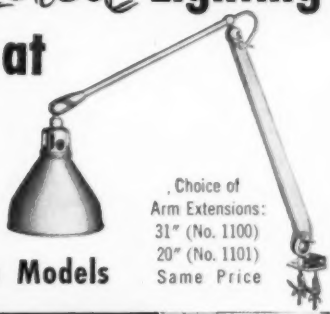

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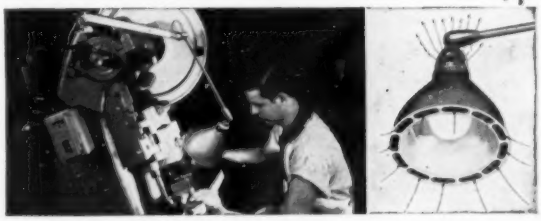

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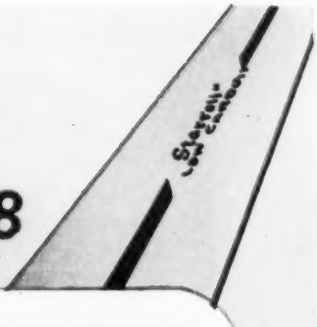

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BUILT-IN SAFETY FACTOR

that helps save time and money!

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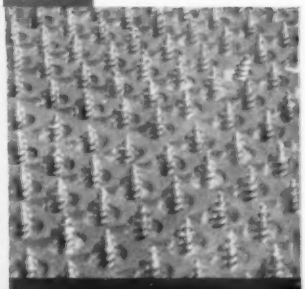
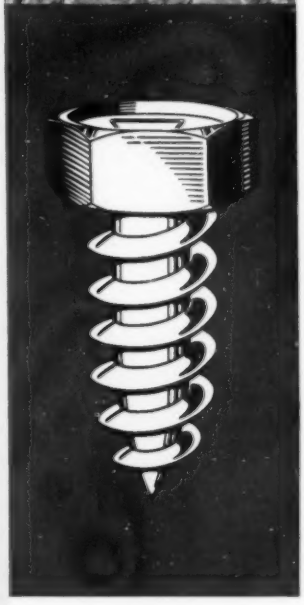
Thousands of users have found P-K's "built-in" safety factor... the extra-ability to withstand highest torque without breakage... helps end annoying slowdowns, excessive rejects, assures rugged dependable fastenings in the plant—in shipment—and in the field. P-K Self-tapping Screws are available in a wide variety of types, sizes and head styles for use in steel, nonferrous metals, compositions, wood, plastic and many other applications.





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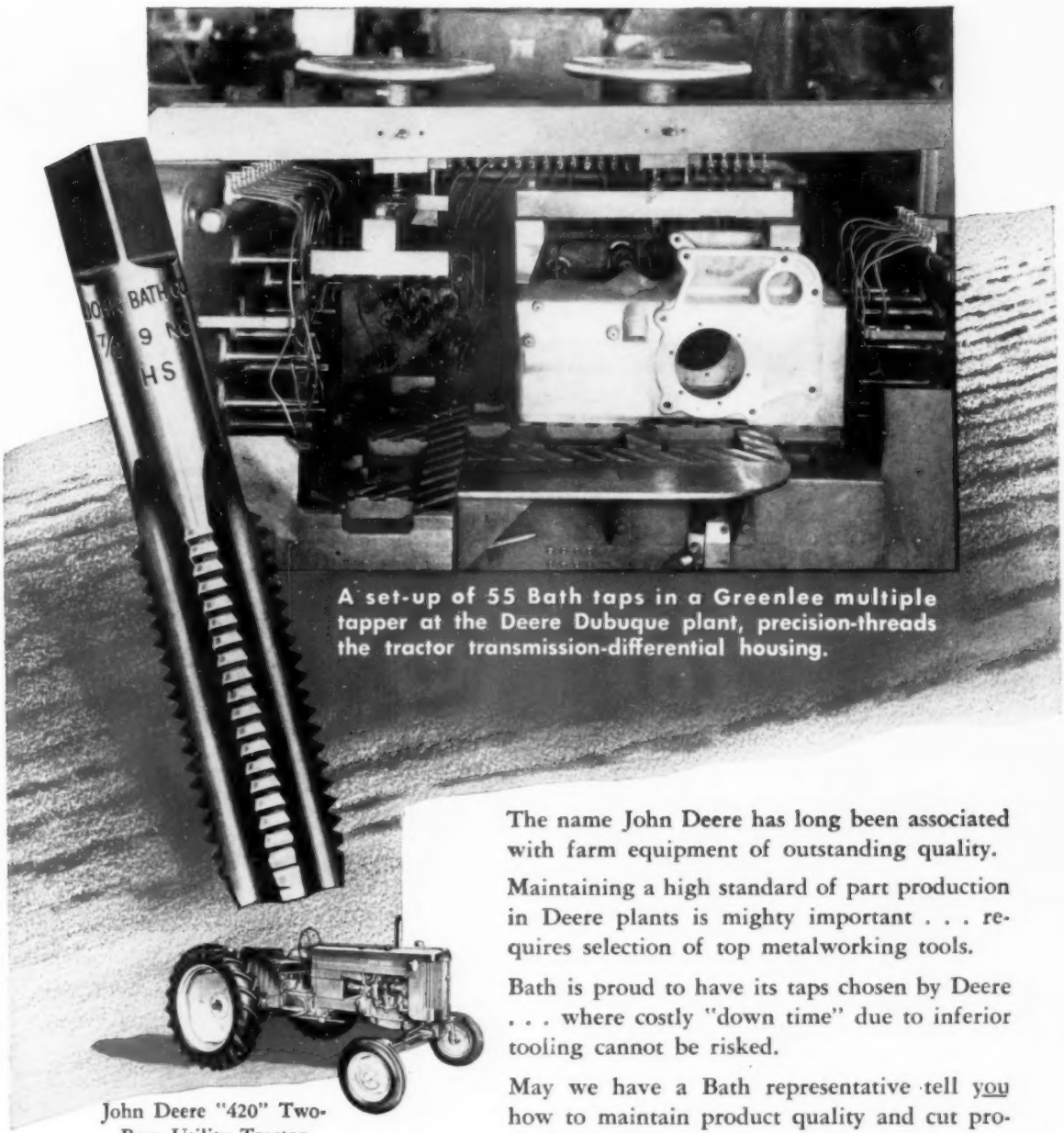

A set-up of 55 Bath taps in a Greenlee multiple tapper at the Deere Dubuque plant, precision-threads the tractor transmission-differential housing.

John Deere "420" Two-Row Utility Tractor

The name John Deere has long been associated with farm equipment of outstanding quality.

Maintaining a high standard of part production in Deere plants is mighty important . . . requires selection of top metalworking tools.

Bath is proud to have its taps chosen by Deere . . . where costly "down time" due to inferior tooling cannot be risked.

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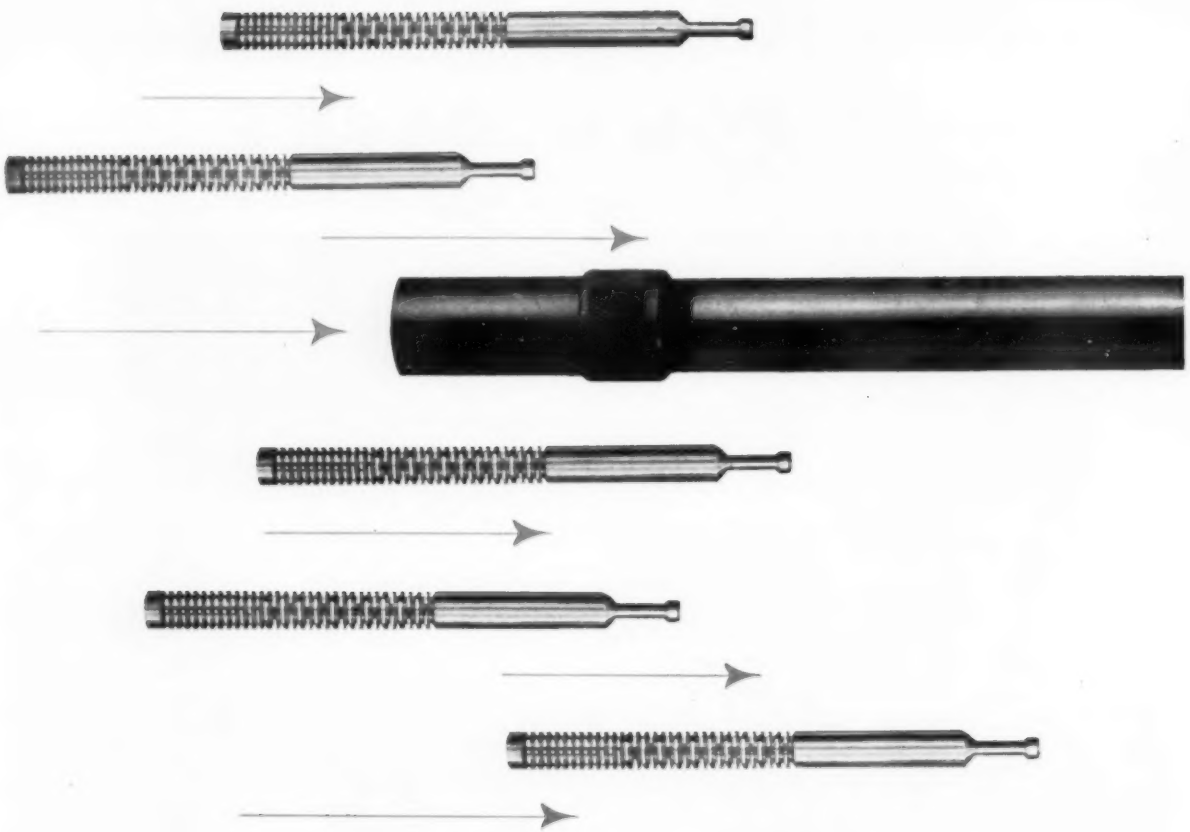

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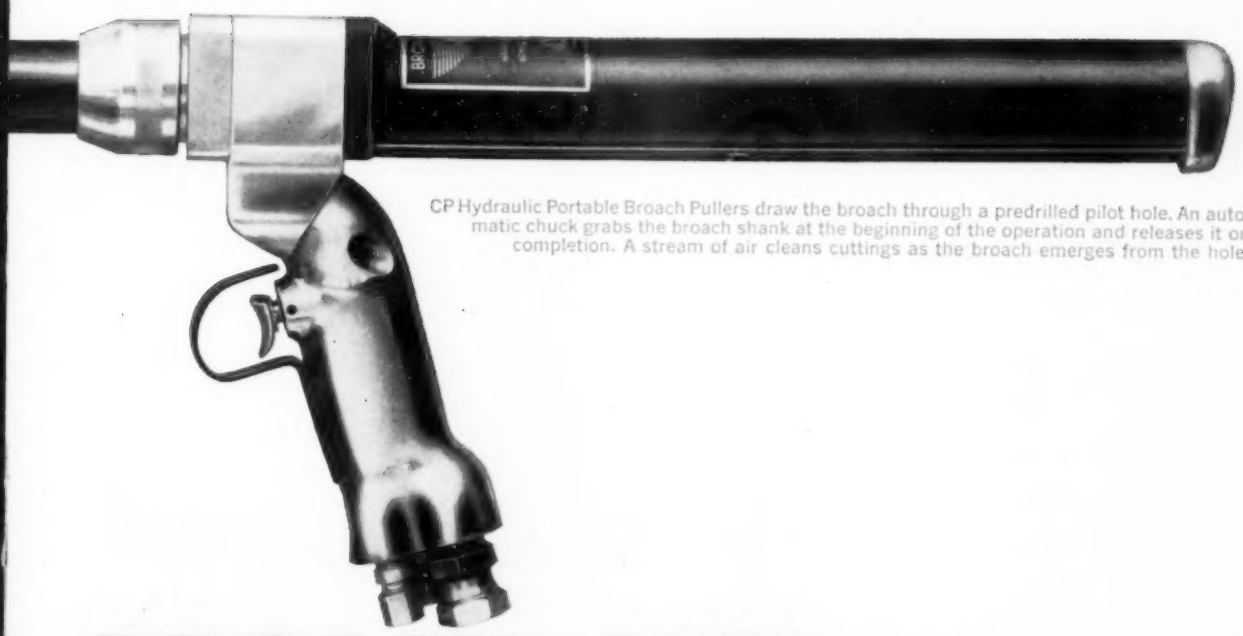
Now you can take a 9-pound portable hydraulic tool to the work and finish round holes to tolerances as close as .0002″ in a matter of seconds. This new and highly productive method is preferred over reaming because of its greater accuracy and lower labor and tooling costs. Round holes *are really* round and meet every standard for size, concentricity, squareness of bore axis with face, absence of taper, and bell mouth. In addition, round pilot holes are quickly converted to square, hex, oval, splined or keyed shapes . . . and hole walls are "mirror finished". Capacity: 3/16″ to 5/8″ diameter holes.



CP Hydraulic Portable Broach Pullers draw the broach through a predrilled pilot hole. An automatic chuck grabs the broach shank at the beginning of the operation and releases it on completion. A stream of air cleans cuttings as the broach emerges from the hole.

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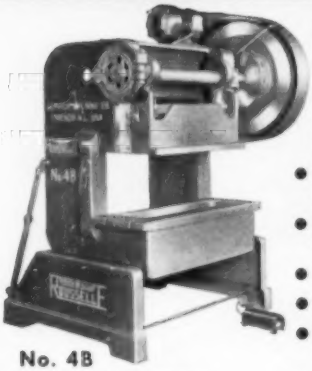

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A STANDARD WITH

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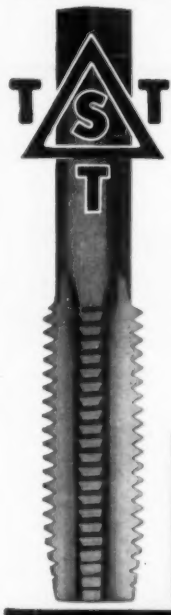
DELIVERS
FULL VALUE



Yes! Sossner taps are tempered, not just once, not just twice, but THREE TIMES. The result . . . a tougher, more reliable, longer lasting tap . . . less chipping, breakage.

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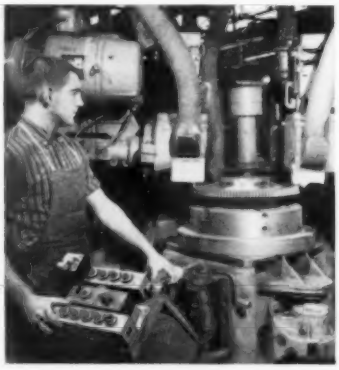
Flying finish for jet engine parts

...10 times as fast with precision OSBORN Brushamatic® Methods



JET ENGINE COMPONENTS *are precision finished automatically at high production rates on Osborn Brushamatic® 51-OOL Machine.*

HERE'S how a jet engine manufacturer has broken a production bottleneck . . . saved dollars and days in the precision-finishing of jet engine components . . . with Osborn Brushamatic® Methods.

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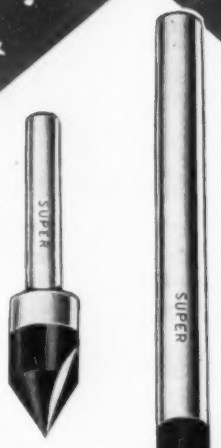
Brilliant Performers Join the Original Carbide Tool Line



New solid carbide single flute countersink #CS and center lap #CL.

Solid carbide flute section increases rigidity, eliminates chatter. Sharpening is by face grinding only. #CS has 82° taper, #CL has 60°. Available in 3/8", 1/2", 3/4" diameters, all 1/4" shanks. #CS available to order with 60° taper.

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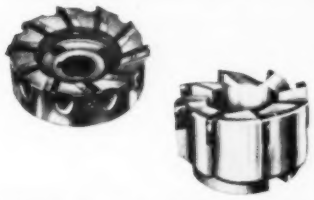
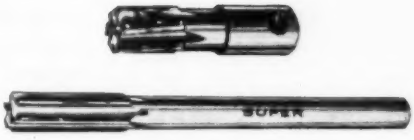
New straight shank carbide chucking reamer, #RCB and #RCS, with solid carbide flute section.



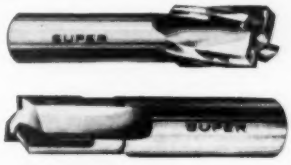
Milling cutters now in stock with premium carbide grades.

Standard and special carbide single point bits —turning, facing, threading, boring.



Reamers, all types. Stub screw machine and carbide tipped shown.

Carbide tipped and solid carbide twist drills, straight and tapered shanks, every type and purpose.



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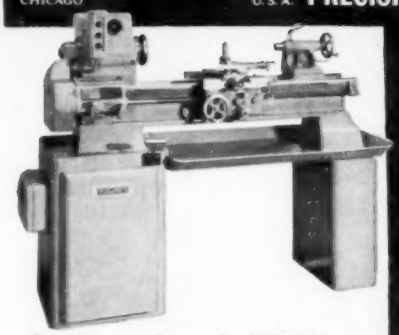
SHELDON *Variable Speed* PRECISION LATHES

CHICAGO U.S.A.



from

to

in 9 seconds or to any intermediate speed INSTANTLY

Just raise or lower the T-handle control, and watch the large tachometer dial in the headstock! Power driven speed changer accelerates or slows the lathe to any desired speed in seconds. 10:1 ratio, gives from 200 to 2000 rpm in direct drive or 40 to 300 rpm in back gear.

Oversized pulleys and shafts are fully supported (eight bearings). Double V-belts throughout eliminate slippage and deliver full power to the spindle. This lathe takes heavy cuts at all speeds and precision finish cuts at high speeds.

A precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

Write for "Variable Speed" Catalog

SHELDON MACHINE CO., Inc.
4229 N. Knox Ave. • Chicago 41, Ill.

USE READER SERVICE CARD; INDICATE A-5-224-2

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

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WAY GUARDS

- KEEP WAYS CLEAN
- SAVE THE MACHINE
- SAVE THE MAN

Made by experienced men to fit your needs.

MADE OF OIL RESISTANT COATED FABRIC

HIGH ABRASION TEST

WRITE FOR DETAILS

CAN-PRO Corporation
MCWILLIAMS STREET
FOND DU LAC, WISCONSIN

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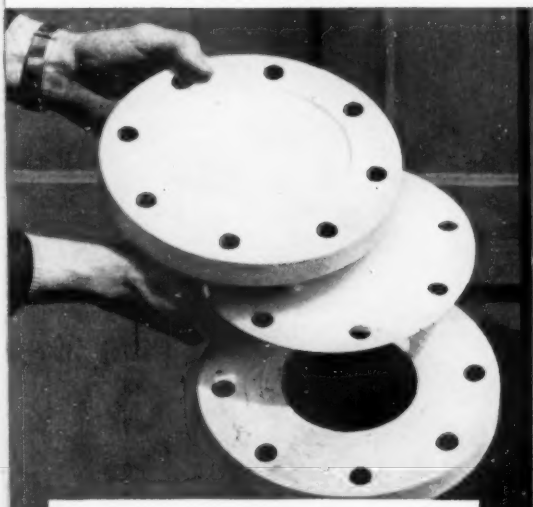
IDEAS IN THE MAKING WITH
CIBA ARALDITE EPOXY RESINS

SHIPPING TUBES manufactured with CIBA Araldite® Epoxy resins and glass get to the "core" of a problem for major petroleum producer.

THE PROBLEM

Between drilling locations in the Middle East and geological laboratories in Oklahoma are many costly air-freight miles over which to speedily transport heavy core samples for analysis.

THE SOLUTION



Shipping tubes like this made of Araldite Epoxy and glass weighing only 17½ pounds now replace 300 pound steel tubes. Not only do the Epoxy-glass tubes provide the light-weight strength with safety required but also provide the necessary non-contamination without special coating so that sample liquids could be shipped with core samples.

THE RESULT

Core samples and liquids are now flown in from all the far-flung drilling locations of a major oil company at a 1 to 17 saving in air-freight costs.

Shipping Tubes produced by Ed Conley Plastic Corp., Tulsa, Oklahoma.

CIBA

"FIRST IN EPOXIES"

CIBA COMPANY INC., Plastics Division
Kimberton, Pennsylvania

TE 5-8

Please send me full information on CIBA Epoxy Resins for tubing applications ☐
I am also interested in Epoxy Resins for

☐ Tooling ☐ Structural Laminates ☐ Surface Coatings
☐ Electrical ☐ Multi-purpose Adhesives ☐ Plastic Body Solders

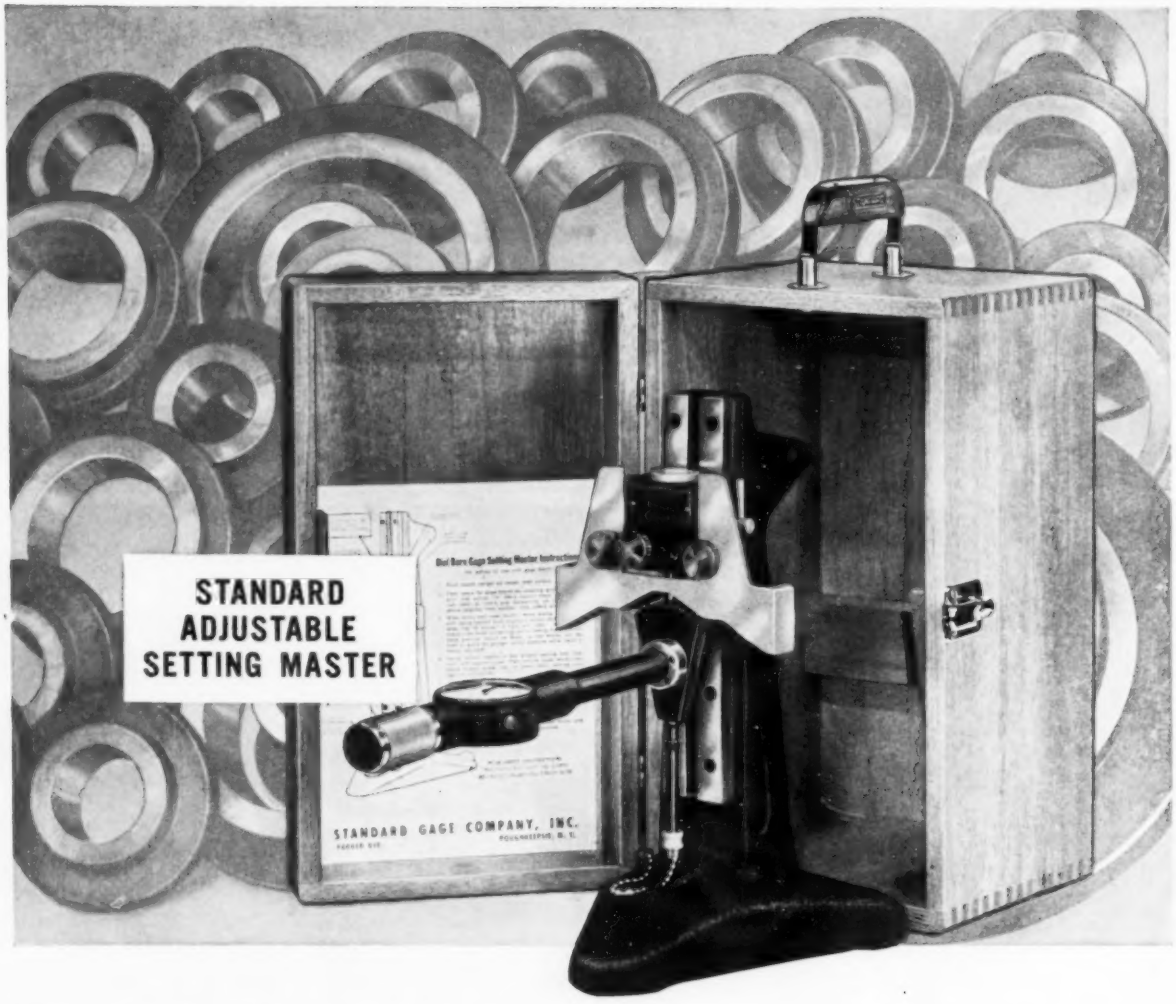
NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ STATE _____

In the U. S. and Canada, CIBA produces basic resins only.



One *Standard* Dial Bore Gage Setting Master Replaces Dozens of Expensive Ring Gages

STANDARD's Setting Master saves the cost and inventory of stocking high-priced ring gages for every size hole; eliminates costly, time-consuming surface plate set-ups.

Now you can set dial bore gages to X accuracy in less than 5 minutes. The 7″ Master sets to *any* diameter from 1″ to 7″; the 14″ model from 1″ to 14″.

Lightweight, portable STANDARD Setting Masters can be used in vertical or horizontal positions. Adjustable anvil pressure is automatically controlled, eliminating errors due to operator "feel." Large diameter, carbide-faced anvils facilitate quick, accurate settings with any standard gage blocks. Both 7″ and 14″ models available from stock.

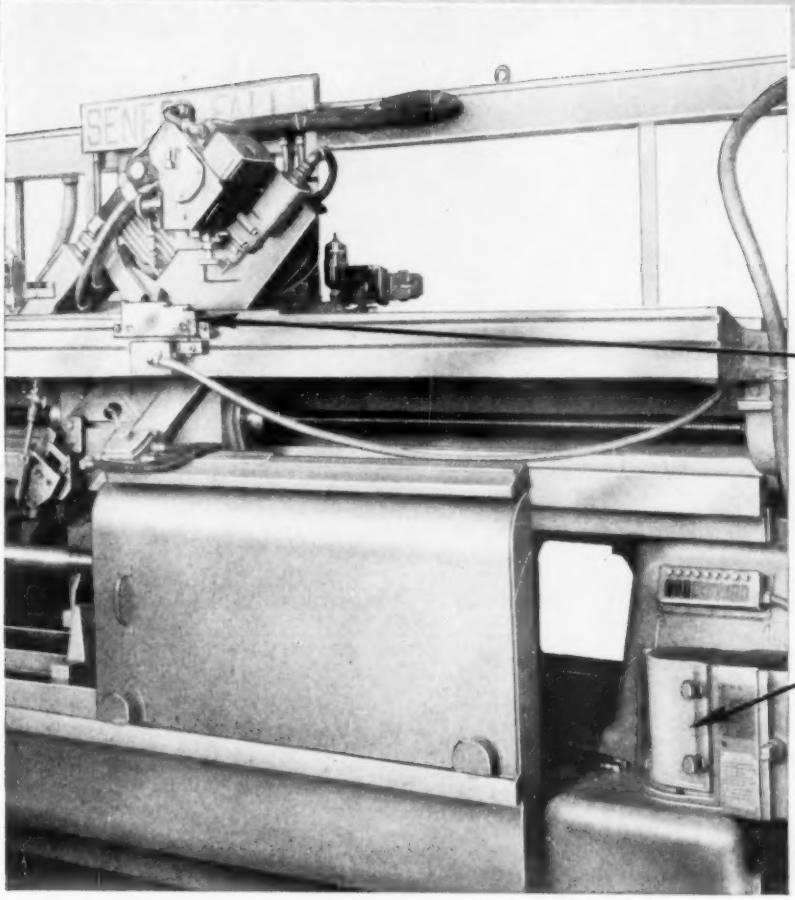
Write for special bulletin or, ask the *Man from Standard*

STANDARD® SINCE 1925 GAGE COMPANY, INC.
POUGHKEEPSIE, N.Y.

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES

CHANGE-OVER TIME CUT 300% WITH THIS

SENECA FALLS MACHINE & WORK CONTROL SYSTEM



Nothing could be simpler!

1st

Change template to obtain correct geometry of new work piece.

2nd

Change "stored intelligence" units to supply correct machine management for new work piece.

This new technology in automatic machine control brings the metalworking industry to the threshold of an unprecedented era in machining efficiency.

Templates are accurately designed to obtain correct geometry for each work piece; thereby minimizing the chances of machining errors at production levels. Another feature which facilitates fast change-over from one part to another is that the templates are designed to compensate for variations in size of the work pieces eliminating tool setting and trial cuts.

A prominent tractor manufacturer has selected Seneca Falls Model "Q" Lathes, utilizing this Work Control System, because of the great saving in change-over time in producing a variety of parts.

Our technical staff will be happy to supply further information on this system.

SENECA FALLS MACHINE

ENGINEERED FOR PROFIT

SENECA FALLS MACHINE CO.

SENECA FALLS, NEW YORK

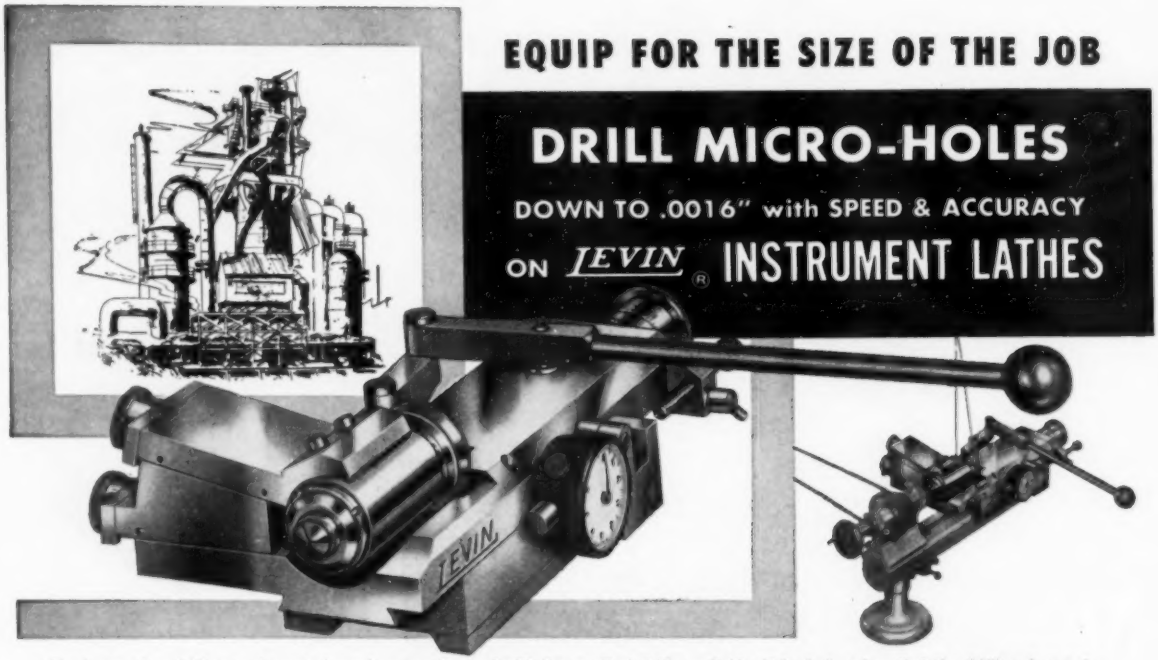
Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

EQUIP FOR THE SIZE OF THE JOB

DRILL MICRO-HOLES

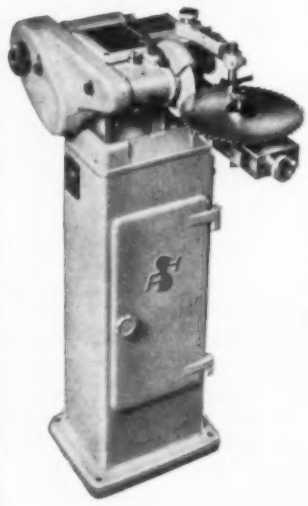
DOWN TO .0016" with SPEED & ACCURACY

ON LEVIN® INSTRUMENT LATHES



The Levin micro-drilling equipment shown here can be used with the smallest drills available. It is designed so that the drilling does not depend on the operator's sense of feel. The drill can be retracted for chip removal and returned to the drilling position without striking the bottom of the hole. While commercial drills can be had as small as .0016" this micro-drilling apparatus has successfully produced holes as small as .0006". **Send for catalog M describing complete line of instrument lathes and accessories. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-228-1



You CAN Resharpen High Speed Band Saw Blades "TEMPO"

The new universal automatic saw blade grinding machine for generating straight or curved teeth **without depending on the shape of the grinding wheel.**

For circular saws, power hack saw blades, and **HIGH SPEED STEEL BAND SAW BLADES.**

▲

See this machine Booth 972 ASTE Show, Philadelphia

CAWI MACHINE CO., INC.

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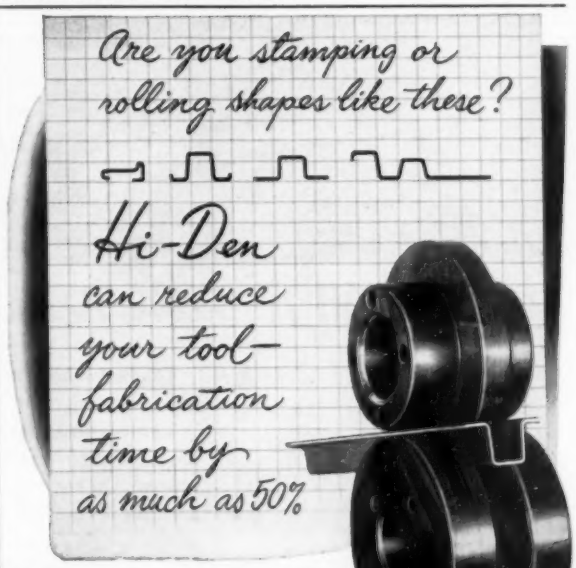

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

Parkwood Laminates, INC.

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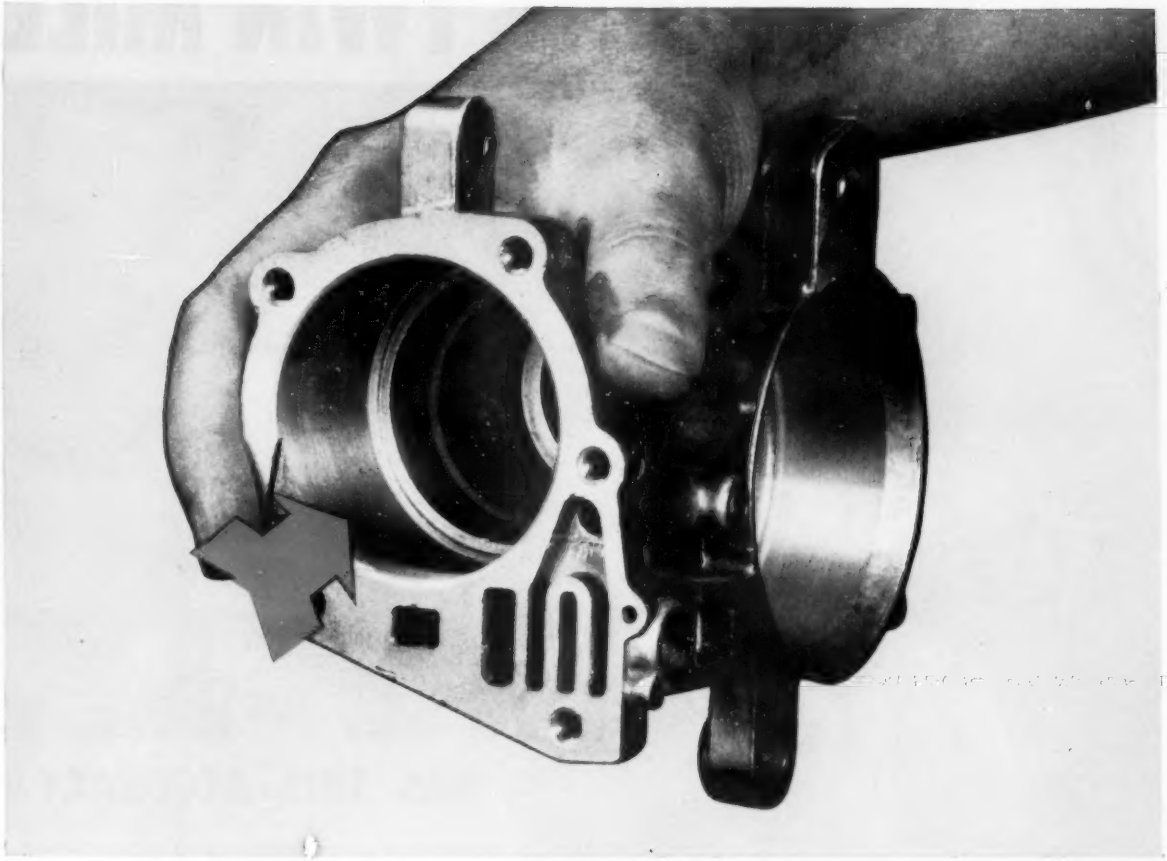
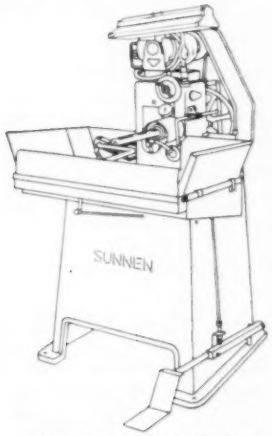


HOW WOULD YOU PRECISION-FINISH THIS BLIND HOLE?



Diameter range of standard honing tools: 1/8" to 2 5/8"

This die-cast aluminum valve part called for a geometrically perfect round hole . . . with maximum finish of 16 micro-inches, neither obtainable on precision boring equipment.

The simple solution was to follow the boring operation with Sunnen Honing . . . leaving just enough stock to correct errors and produce the required finish.

Sunnen Honing maintains previous alignment, guarantees tolerance to .0001" . . . and assures consistent precision-finish from part to part. The part stabilizes itself on the honing tool and requires no chucking or fixtures. Thus, the hole can be gaged at any time until the specified size is reached. Result is geometric accuracy of roundness and straightness. No scrap loss!

Average Sunnen Honing Machine installation with tooling is about $1,000.

send for five informative

honing booklets

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PRODUCTS COMPANY
HONING

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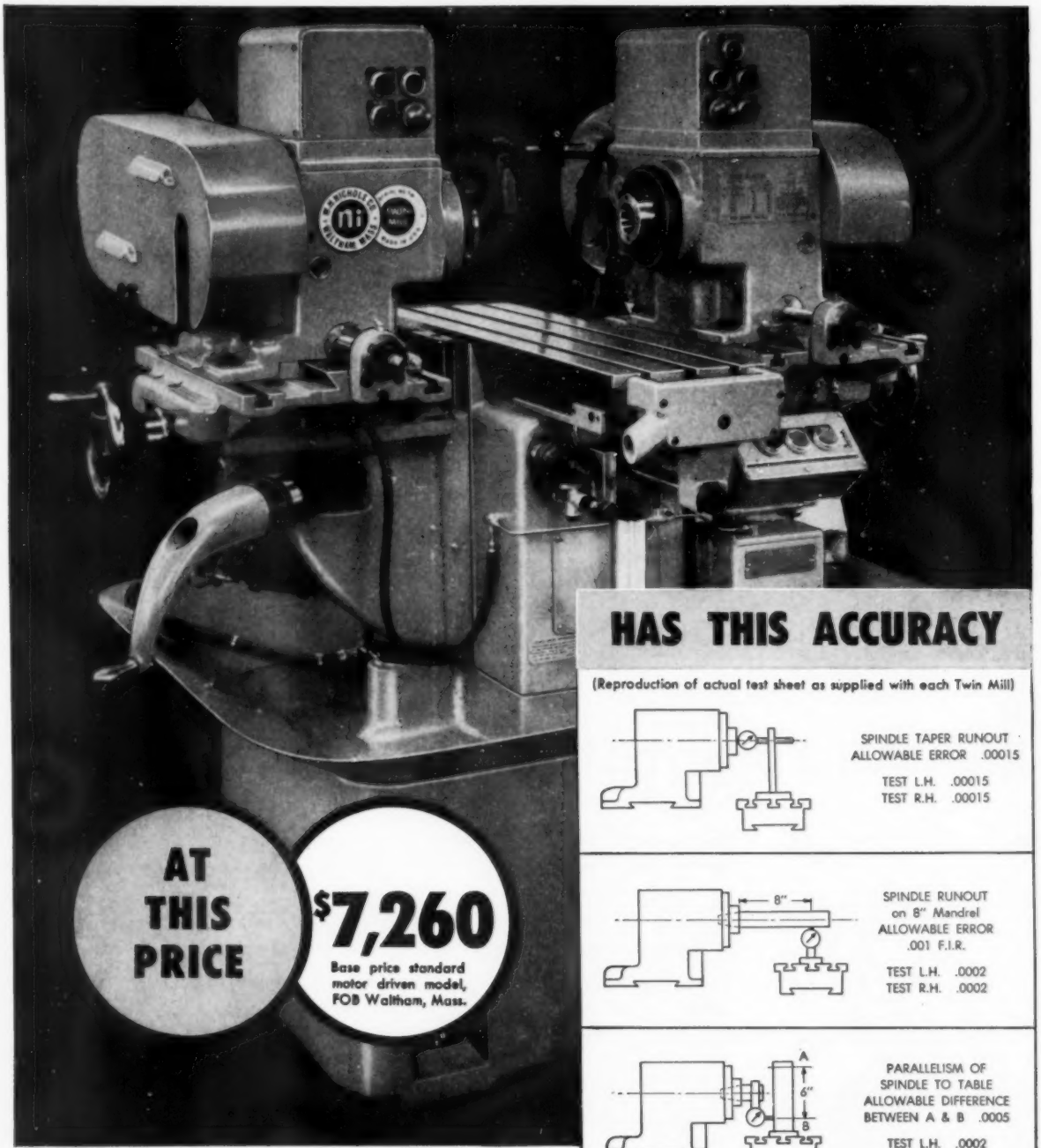
Canadian Factory: Chatham, Ontario

7616

Only the NICHOLS TWIN MILL



AT THIS PRICE

$7,260

Base price standard motor driven model, FOB Waltham, Mass.

Manufactured by W. H. Nichols Co.

HAS THIS ACCURACY

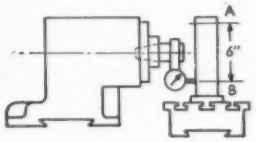
(Reproduction of actual test sheet as supplied with each Twin Mill)

SPINDLE TAPER RUNOUT
ALLOWABLE ERROR .00015

TEST L.H. .00015
TEST R.H. .00015

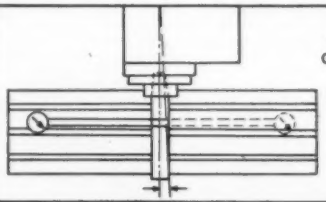
SPINDLE RUNOUT
on 8" Mandrel
ALLOWABLE ERROR
.001 F.I.R.

TEST L.H. .0002
TEST R.H. .0002



PARALLELISM OF
SPINDLE TO TABLE
ALLOWABLE DIFFERENCE
BETWEEN A & B .0005

TEST L.H. .0002
TEST R.H. .0002



RIGHT ANGULARITY
OF TABLE TO SPINDLE
ALLOWABLE
FRONT TOE-IN .003
24" SPAN

TEST L.H. .003
TEST R.H. .003

Write for details on the complete Nichols line,
"The Millers That Use Their Heads"

NATIONAL DISTRIBUTORS

The ROBERT E. MORRIS Company

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Series 101A
150 psi Air
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Meet JIC Standards
Fit where
others won't!

O-M Cylinders give power new dimensions in close quarters

Compared with cylinders of conventional design, having the same size bore, and activated by the same operating pressure, O-M's original Internal Key-type Cylinders develop more power in ⅓ less space on both air and hydraulic circuits.

These compact, powerful components, that fit where others won't, are ruggedly constructed to stand up under protracted service within a wide range of operating pressures. The O-M Internal Locking Key simplifies disassembly, inspection, and service with no alignment problems in reassembly. Besides, the ports can be oriented to any position.

The unique O-M design also assures maximum versatility. By using a majority of standard parts, you get the advantage of "special" cylinders designed to do your job better at a very nominal cost over standard cylinders. These and other engineering advantages and economies of O-M Internal Key-type Cylinders suggest uses in a wide variety of original equipment.

O-M Internal Key-type Air and Hydraulic Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Completely interchangeable parts and mounts. Immediate delivery on many sizes.

Mail Coupon TODAY *for Bulletins 101A (O-M Internal Key-type Air and Hydraulic Cylinders), and 105 (O-M Series T-H Heavy-Duty Hydraulic Cylinders).*

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

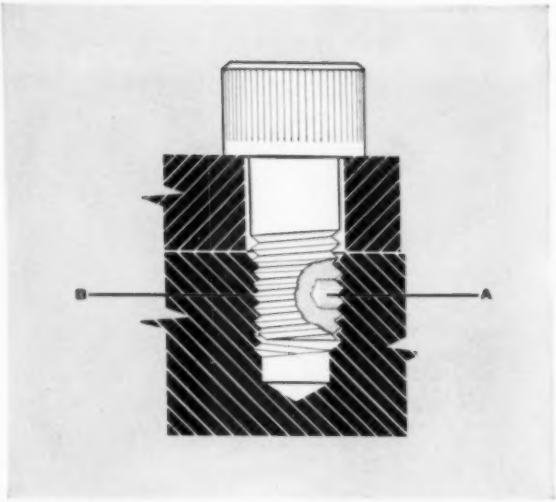
☐ Have representative call
☐ Send Bulletins 101A and 105

Name_____ Position_____

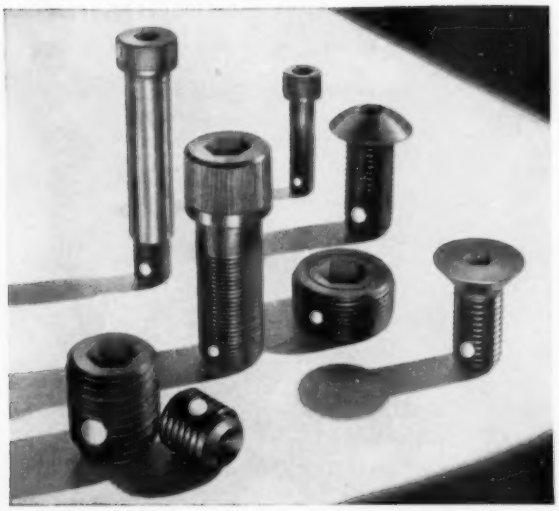
Company_____

Address_____

City_____ Zone____ State_____



How Nylok Locks. Resilient nylon pellet (A) sets up lateral thrust, smoothly wedging mating threads together (B). Locking action is entirely on threads and is positive, seated or unseated. UNBRAKOS with Nylok are easy to remove and are reusable.



Self-Locking UNBRAKO Socket Screws, in a full range of standard types and sizes, are stocked by your authorized SPS distributor. Permanently installed locking pellets are serviceable from —70 to +250°F and will not dry out, rot or shrink.

Only Screws That Stay Tight Are Reliable!

Use UNBRAKO socket screws with Nylok*

to increase the reliability of your mechanical assemblies

Fastener reliability is essential not only in the products you manufacture, but also in the machinery you use. Yet 9 times out of 10, the ordinary threaded fastener will work loose if subject to impact, shock or vibration . . . and it usually is. In the case of industrial equipment, this tendency of fasteners to loosen can mean added maintenance costs, production delays, or even damage to machinery. With consumer goods, it can mean extra service calls and repairs—irritating to the customer and, more often than not, unprofitable for the manufacturer.

Past efforts to solve this problem have involved use of lockwashers, cotter pins and wiring. These conventional locking devices are not always completely reliable. Lockwashers sometimes snap or lose their spring; and with cotter pins or wiring partial loosening is likely. Furthermore, these devices take extra time and labor to install.

UNBRAKO socket screws with Nylok offer you a simple, practical solution to this problem of fastener reliability. An UNBRAKO with Nylok is a single self-locking unit—requires no auxiliary fastening elements. The tough, resilient nylon pellet—permanently installed—forces mating threads tightly together, locking the screw securely, seated or not, wherever wrenching stops. It will not work loose, despite severe vibration.

Off the shelf, a self-locking UNBRAKO may cost you slightly more than an ordinary screw. But f.o.b. your product, it usually costs less . . . assembly time, labor and reliability considered. See your authorized SPS distributor for complete details. Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

hiRf
High Reliability factor

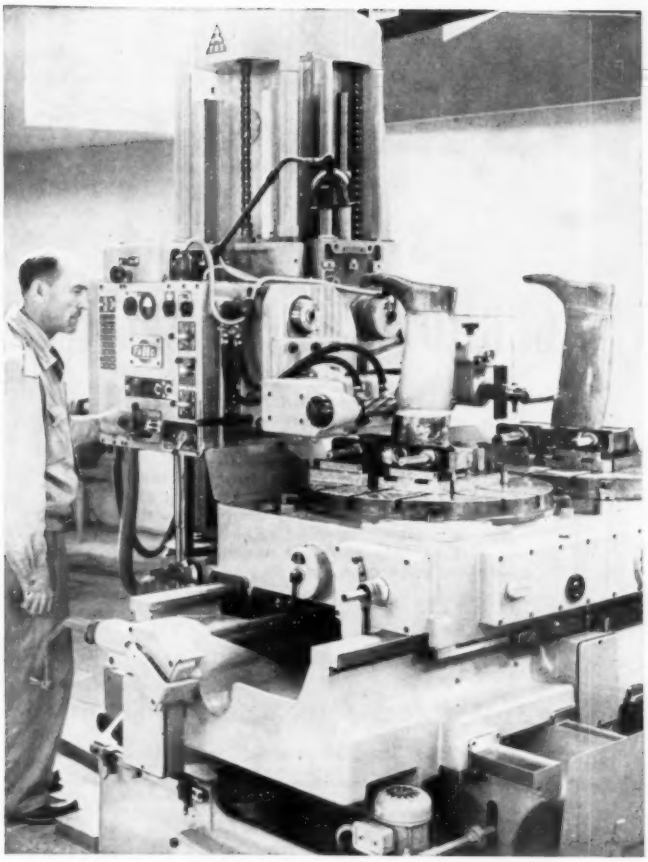
At SPS we apply a dynamic standard of quality—continually refined—so that our fasteners will always have the high reliability factor required by today's faster speeds and greater dynamic stresses. By using SPS fasteners in your assemblies, you help increase overall reliability—the certainty of predictable performance under actual service conditions.

For more information on the full meaning of reliability, write for a copy of the new SPS booklet "Concerning High Reliability."

We also manufacture precision titanium fasteners / write for free booklet

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.



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U.S. WORLD TRADE FAIR
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MODERN CZECHOSLOVAK MACHINE TOOLS

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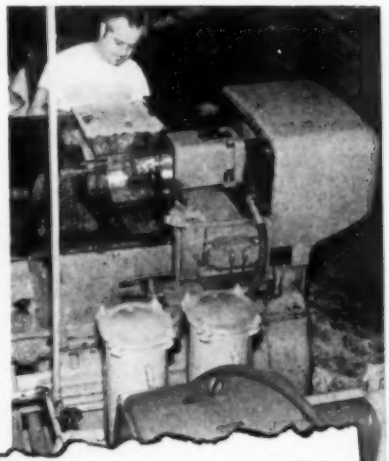
GUN DRILLING? This testimony speaks for itself:

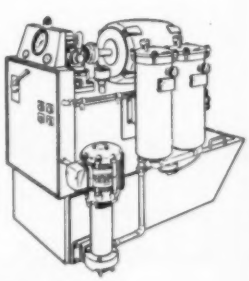


"Modern gun drilling techniques require precision-engineered fluid transfers . . . and an absolutely clean supply of coolant delivered at high pressures and controlled temperatures. The Sealol equipment in our plant has performed with complete reliability . . . on long production runs."

C. S. Einsiedler, Vice President in Charge of Production, Standard Die Set Co., division of Harsco Corp.

Sealol's DRILL ADAPTOR and COOLANT SUPPLY UNIT permit CLOSE TOLERANCE finished HOLES in one HIGH-SPEED pass!

SEALOL FLUID TRANSFER — feeds coolants from stationary source to rotating gun drill . . . at speeds to 10,000 RPM, pressures to 1000 PSI . . . directly to cutting edge of drill keeping work cool, flushing chips out continuously.



SEALOL HI-PRESSURE COOLANT SUPPLY UNIT — for all types of precision drilling . . . filters, cools, pumps coolants at pressures to 1,000 PSI . . . to 40 GPM (higher capacity units available).

SEALOL

SEALOL CORP
435 Post Road, Providence 5, R. I.

☐ Please send Bulletin describing Sealol Drill Adaptor and Coolant Supply Unit.
☐ Please send Informative Booklet, "An Introduction to Gun Drilling."

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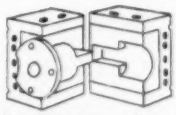
Repairing broken dies

Anchoring punches & dies



Holding irregular work pieces

3 Time-Saving CERROTECHNICS Shortcuts

These and 60 other CERROTECHNICS applications are saving time and money in many metalworking operations. CERROTECHNICS embodies practical methods of using bismuth alloys (CERRO ALLOYS) in a wide variety of industrial applications. CERRO ALLOYS . . . low-temperature-melting metals . . . simplify and shortcut many intricate operations. Send for the complete list of CERRO ALLOY applications . . . it can help you make substantial savings in tooling and production costs.

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CERRO DE PASCO SALES CORPORATION

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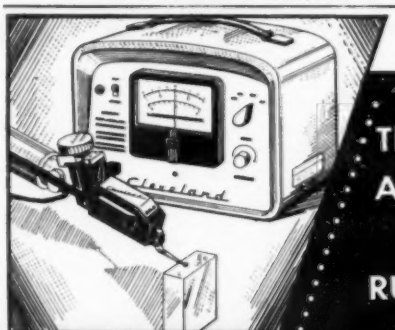

The MOST ACCURATE MOST RUGGED—

HEIGHT GAGE

Measures in thousandths, ten-thousandths or millionths of an inch.

The Cleveland INDI-AC is the only indicating height gage which protects the gaging element from accidental blows in any direction.

More INDI-ACs are sold than any other electronic height gage.

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Cleveland INSTRUMENT COMPANY
735 Carnegie Ave. • Cleveland 15, Ohio

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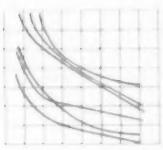
What every good metal man should know about CARBONITRIDING

First of all, it is a good idea to know what equipment will do the best carbonitriding job for your specific requirement. And the best way to find this out is to talk over your problems with the people who have consistently developed the methods and equipment for better, more dependable, more economical carbonitriding results. That would be Lindberg.



Let's look at the record. Lindberg's contributions to carbonitriding and carburizing go far beyond just the building of furnaces to do it. It covers the development of controlled atmosphere generators, the creation of dew point equilibrium curves to establish proper atmosphere values for type of steel and temperatures involved and the exclusive Lindberg Carbotrol to maintain these values automatically in production.

Typical installation of Lindberg Hyen Atmosphere Generator, Lindberg Carbotrol and Lindberg Carbonitriding Furnace.

Then there is the invention of the "dimple" vertical radiant tube which gave new efficiency and economy to fuel-fired atmosphere furnaces. Lindberg's exclusive CORRTHERM electric heating element made practical the use of electricity in atmosphere furnaces.

Add to this our record over the years of building a broad variety of carbonitriding and carburizing furnaces, big ones, small ones, manuals, automatics, fuel-fired, electric, and it seems it's just good common sense to bring your heat treating problems to us. Just get in touch with the Lindberg Field Representative in your locality or write:

LINDBERG ENGINEERING COMPANY

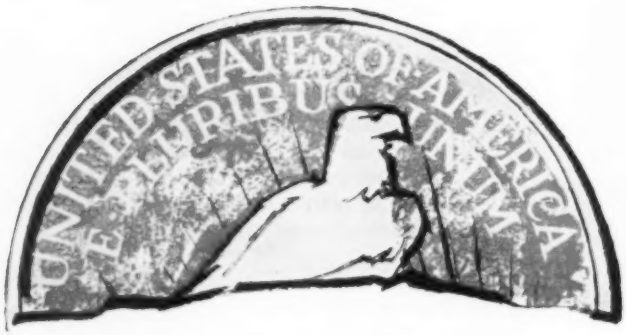
2447 West Hubbard St., Chicago 12, Illinois

Los Angeles Plant: 11937 S. Regentview Ave., at Downey, California.

LINDBERG

heat for industry

Why pay a premium for lightweight tooling metals?.....



DOW MAGNESIUM TOOLING PLATE

.....costs up to 1/3 less!

It costs less for you to buy because you don't pay premium prices for tolerances you may not need. The fundamental characteristics of magnesium permit rolling and oven thermal flattening to a degree of flatness and surface smoothness satisfactory for virtually all tooling uses. This flatness is not obtainable in other lightweight tooling materials without costly machining of the surface.

Magnesium saves dollars after you buy it, too. It's the easiest tooling metal to cut, machine and weld —and, of course, magnesium jigs and fixtures are the easiest to handle. Add to this the durability, soundness, and dimensional stability which magnesium offers, and you have a lightweight tooling metal which cannot be equalled.

Investigate, and you will find that magnesium COSTS LESS TO BUY, COSTS LESS TO FABRICATE, COSTS LESS TO USE. Let a Dow magnesium supplier show you these savings in dollar and cents figures. Contact him today or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1429A-1.

AVAILABLE FROM STOCK AT:

Copper and Brass Sales, Inc., Detroit, Michigan
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Reliance Magnesium Company, Los Angeles, California
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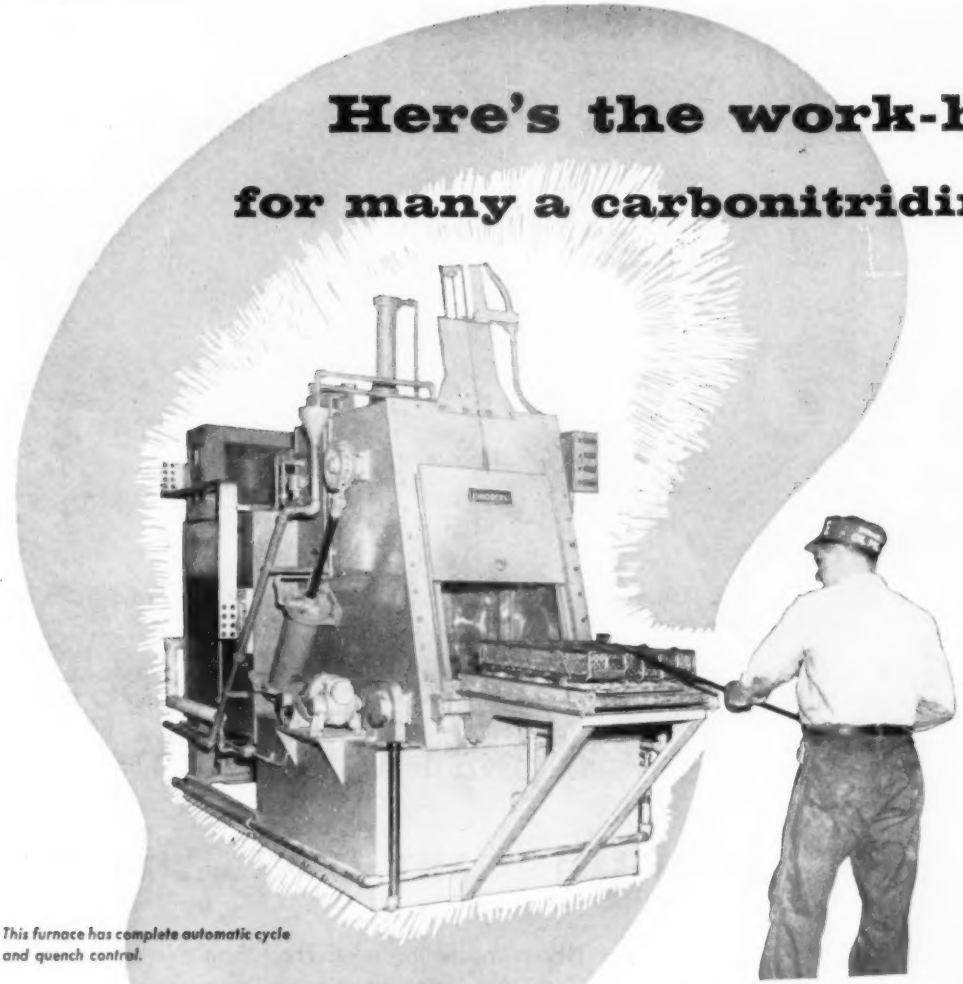
SEE THE DOW DISPLAY at the Philadelphia ASTE Show, May 1-8, Booth 1653.

YOU CAN DEPEND ON DOW

Here's the work-horse

for many a carbonitriding job



This furnace has complete automatic cycle and quench control.

This is the most widely-used carbonitriding furnace of all. Day in and **day out production** of tons and tons of work has proved this furnace's **ability to increase** production quality and volume and reduce costs. It **is a versatile** furnace, too, not only for carbonitriding but for other uses, carburizing, annealing, carbon restoration and many hardening applications.

This type of furnace is available for both manual and automatic operation. It can be equipped either with Lindberg's efficient new vertical radiant tubes for fuel-firing or for electric heating with Lindberg's revolutionary new CORRTHERM element.

Versatile as this furnace is, we don't claim it is the best solution to *every* carbonitriding problem. But, whatever your need may be, talk it over with Lindberg. Our engineers, as they have done in so many instances, will recommend a sound answer—design it, build it, even field-install it if you wish. Just get in touch with the Lindberg plant or the Lindberg Field Representative in your locality. Lindberg Engineering Company, 2447 West Hubbard St., Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Ave., at Downey, California.

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heat for industry

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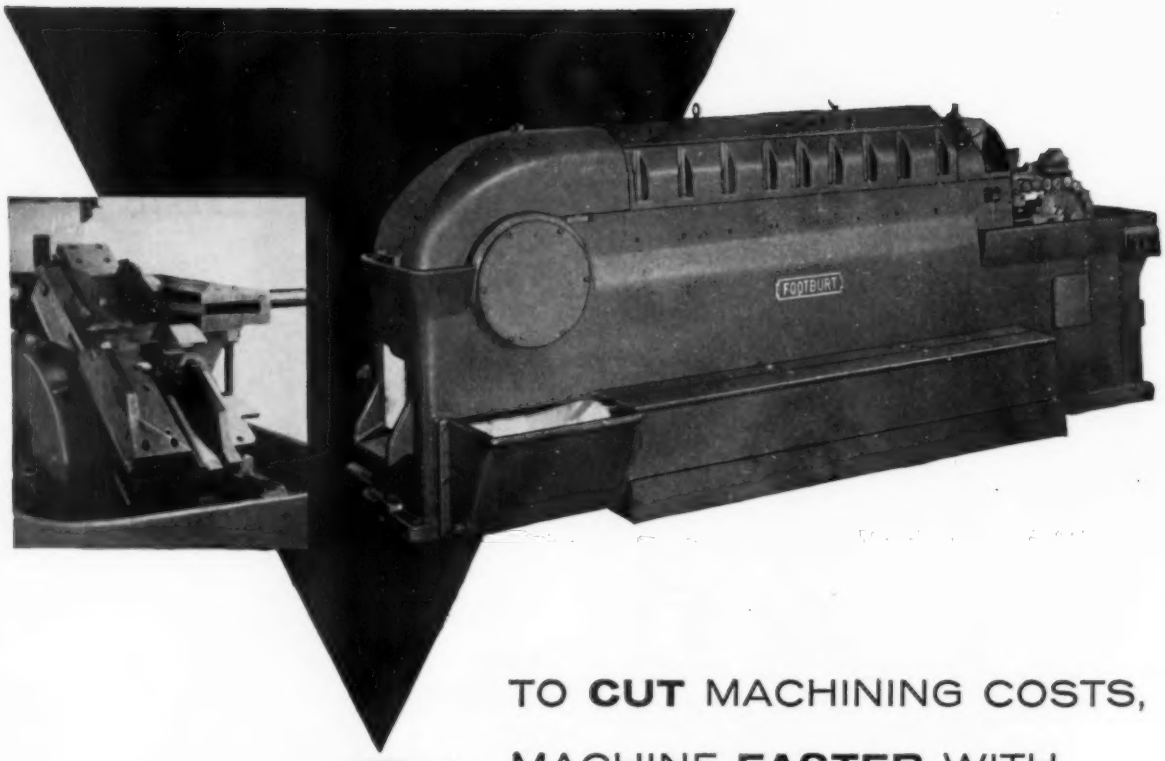

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MACHINE **FASTER** WITH

Continuous broaching

Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

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Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

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HOSE REEL FOR AIR TOOL SUSPENSION —Saves duplicate equipment and maintenance. Saves time on high speed production. Spring tension counterbalances air tools. Powerful spring automatically takes up tool.

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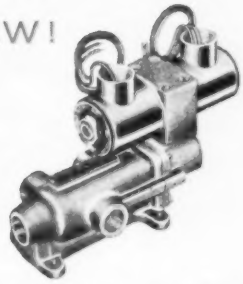

DOUBLE SOLENOID 4-WAY VALVES — Now double solenoid 4-way action available in full series . . . voltage-wise, port size, flow capacity. Permits longer dwell time in either position without continuous electrical energy.

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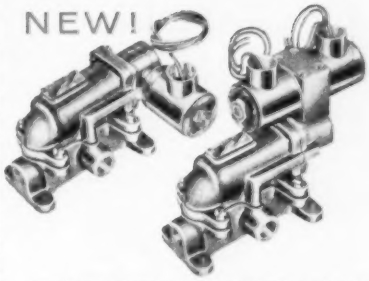

SUB-BASE SINGLE AND DOUBLE SOLENOID VALVES — Greater versatility. You don't have to disturb the piping for service. Reduces "down time" to absolute minimum. Complete series: voltages, sizes, capacities.

NEW!

PILOT OPERATED SUB-BASE 4-WAY VALVES — Sturdy cast meehanite sub-base contains all ports for piping air. Permits removal of valve mechanism for service without disturbing piping. Complete new series!

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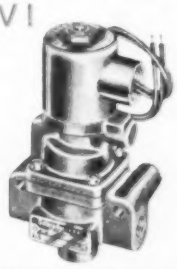

NEW! 3-WAY SOLENOID VALVES—Simple 3-way action available in full series—voltage, port sizes, flow capacities. By shifting pilot chamber head 90°, normally open changes to normally closed, and vice versa!

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2- AND 3-WAY FOOT VALVES — With right angle ports. Give convenience and control with simplest installation. Mount directly on floor. ⅜" N.P.T. Sturdy, compact, and *versatile*. Take minimum space.

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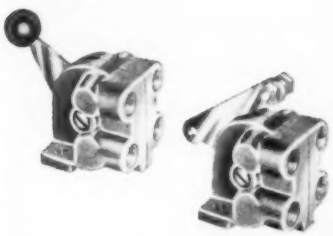

SLIDING SEAL VALVES FOR PIPED EXHAUST — Complete series! 2, 3, 4-way types. ¼" N.P.T. ports. Hand or mechanical lever. Compact, minimum working parts.

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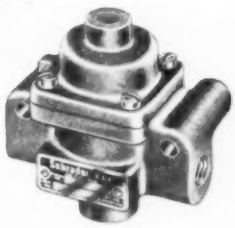

3-WAY PILOT VALVES — Complete new line. Normally open or normally closed types. Ideal for single-acting cylinders. Simple, neat, sturdy. May easily be converted to solenoid.

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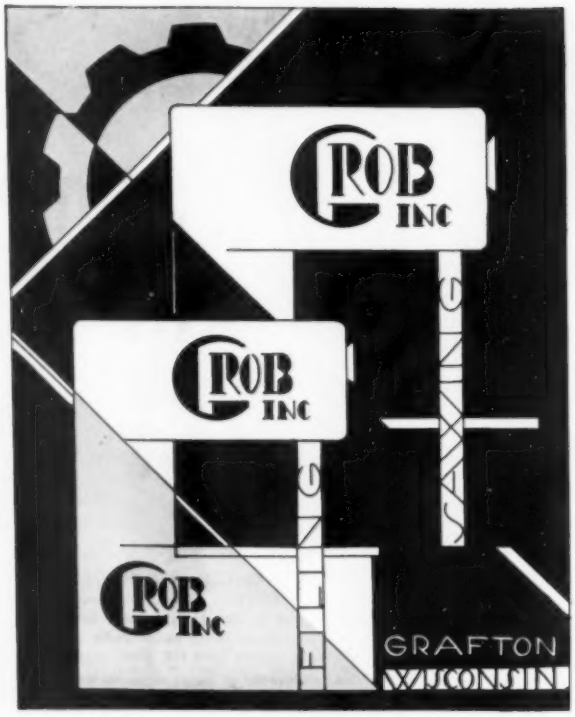

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Magna (magnetic) bit holders, finders and sockets for all power screwdrivers, eliminate "fumbleitis" by firmly holding screws, bolts or nuts in assembly operations. Proven in use in hundreds of plants, Magna-Tip accessories can help push your production up and costs down. Ask your power screwdriver salesman to show you these handy Magna accessories.

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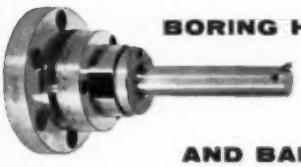

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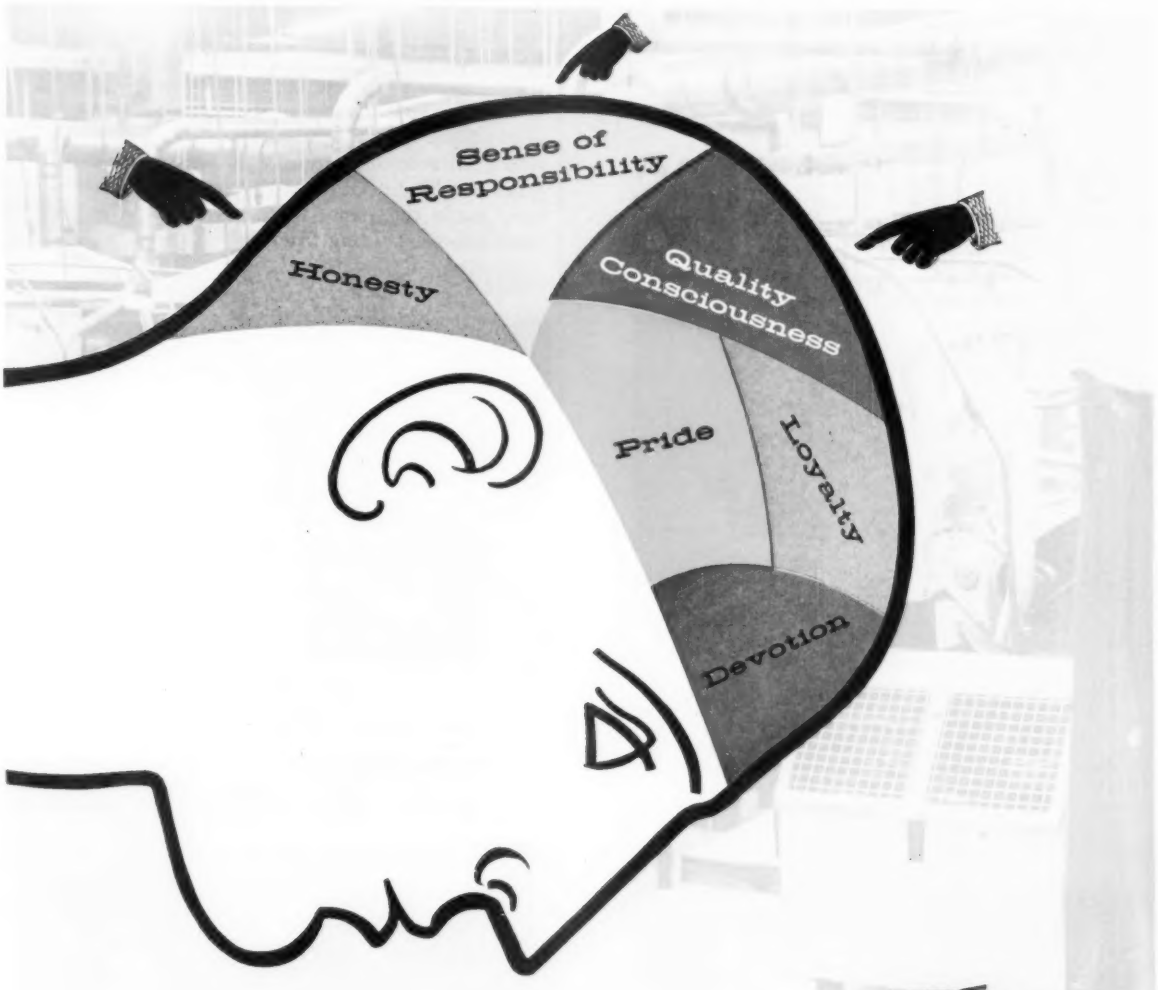

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Rests Right Between Each Operator's Ears

At Pipe Machinery we have no need for floor inspectors . . . no need for control charts to insure the high precision and accuracy of our gages. Our quality control rests where it belongs—right between the ears of the people who do the actual work. Through every step in the manufacture of a Pipe Machinery gage, all our operators feel full and complete responsibility for the quality of the product they are helping to produce. Each man and woman is a self-appointed guardian of the company's reputation. They all have their own inspection equipment. We also maintain a fully equipped constant temperature laboratory where large gages and extremely close tolerance gages are checked.

Do stop in and visit us next time you are in the vicinity. We'd be proud to introduce you to our team of reliable craftsmen . . . a team devoted heart and soul to the job of turning out gages of unsurpassed excellence.

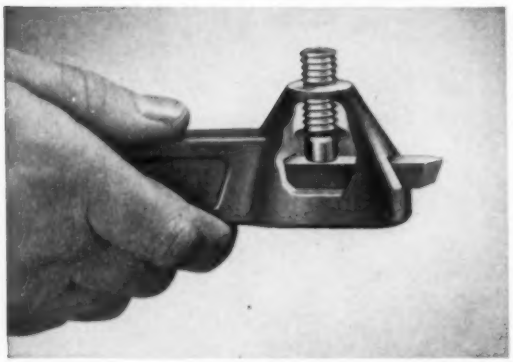
For further information on our complete line of fine gages, write us on your letterhead.

THE PIPE MACHINERY COMPANY *29100 Lakeland Blvd. • Wickliffe, Ohio • Greater Cleveland*

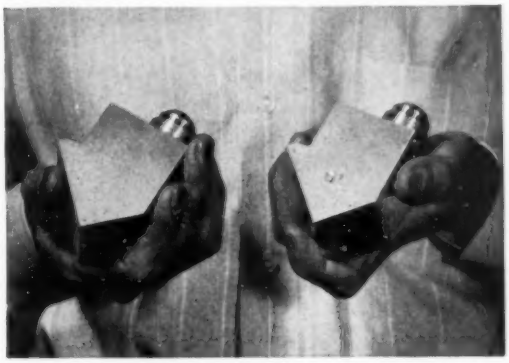
Practical Tooling Tips

Number 1 of a series.

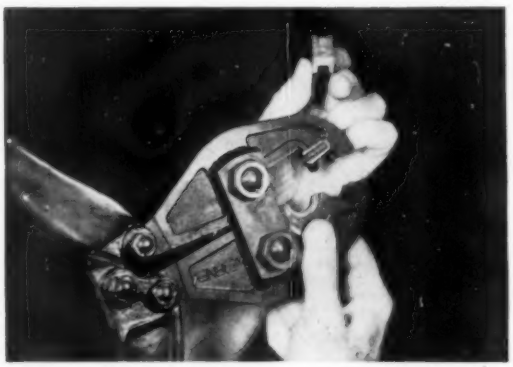
Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?



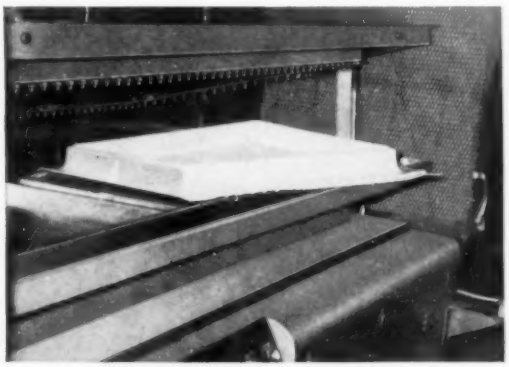
TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad© Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad© Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad© Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.



SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

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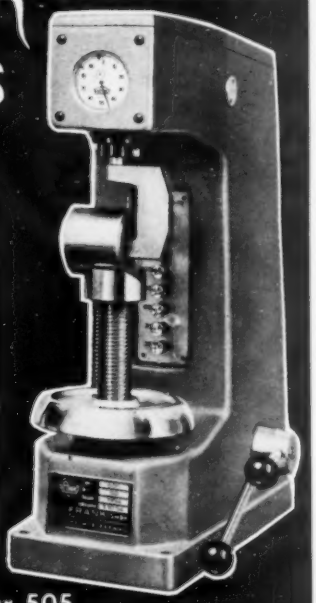

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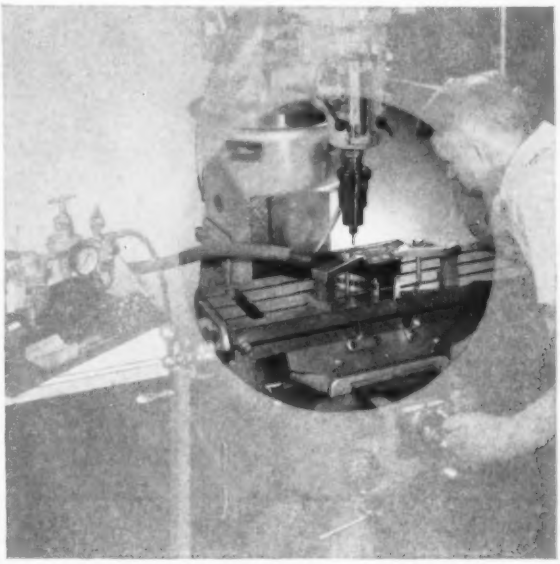

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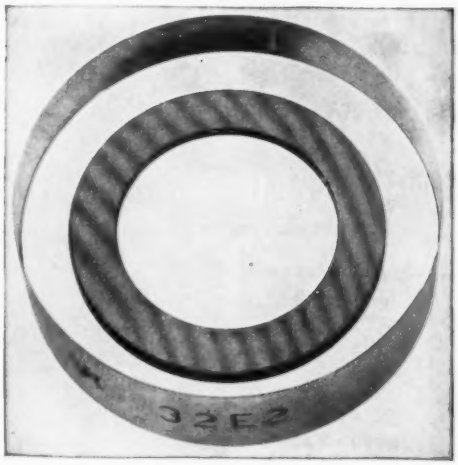
...with VK LIGHT WAVE EQUIPMENT

Van Keuren Light Wave Equipments, standard gage laboratory equipment everywhere, have long been used for checking gage blocks, toolmaker's flats, comparator anvils and other lapped surfaces in the laboratory or inspection room. In recent years, however, VK Light Wave Equipments and flats have become valuable tools on production inspection jobs. Typical is the growing use of optical flats in checking sealing rings of various materials.

The illustration at right of a sealing ring under a 3" diameter fused quartz optical flat shows how easily measurements can be made. The ring* is acceptable on sight. The bands indicate excellent surface finish (sharp definition of bands), and no warp or low edges (uniform band spacing). Flatness is within .000005" across entire ring, and .000002" across ring face (bands curve less than ½ band interval over entire ring, and 1/6 over ring face).

*Product of Sealol Corp., Providence, R. I.



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Tap Cost SAVINGS **98%**

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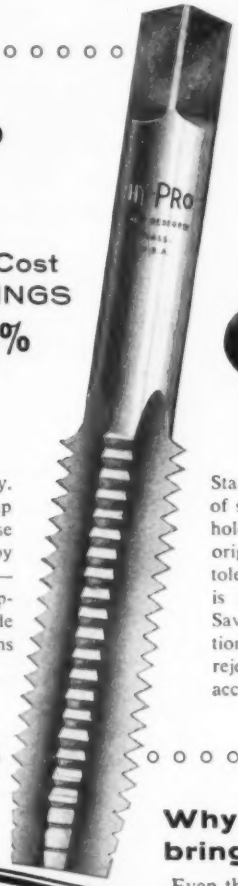

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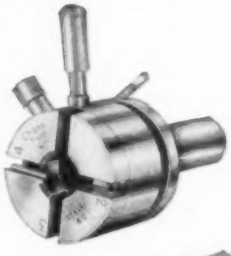

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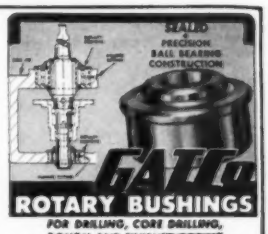

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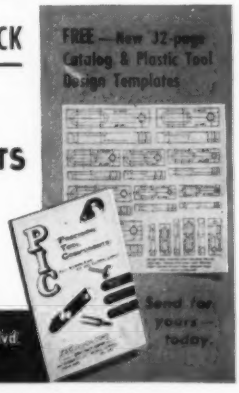

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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 169.

NEW SKINNER VISES NOW AVAILABLE!

Biggest capacity
Opening capacity is equal to the full width of the jaws . . . gives you far more holding room for heavy, accurate machining.

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The rugged jaws, capable of withstanding tremendous strains, are precision machined to hold your finest parts without damage.

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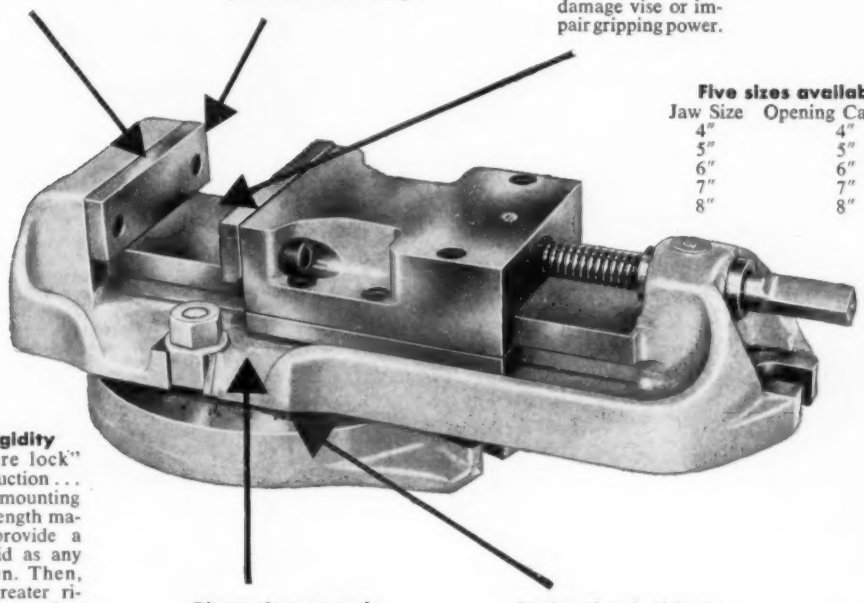
There are no slots or ridges . . . no way for chips to get under movable jaw to damage vise or impair gripping power.



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6″	6″
7″	7″
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The "square lock" way construction . . . wide table mounting . . . high-strength materials . . . provide a vise as rigid as any you've seen. Then, for even greater rigidity, Skinner has made available a center hold-down screw.

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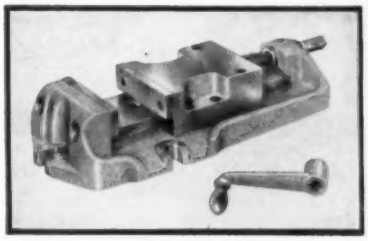
They combine the finest of materials with Skinner's unmatched experience and craftsmanship to give you tremendous holding power!

See your industrial distributor or write us for full details on Skinner's new Series F and FS trough vises today. Write Dept. 185



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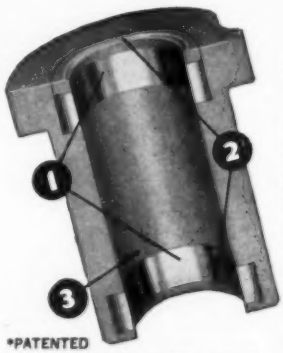

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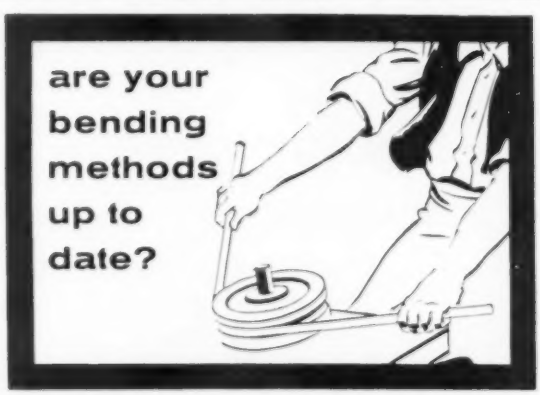

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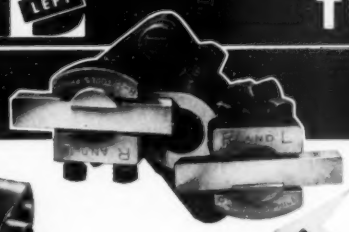
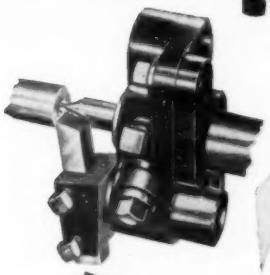
REPLACES AN ASSORTMENT OF 14 TOOLS!

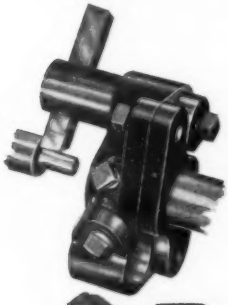


The R and L Turning Tool can be changed from right to left in 10 seconds, and vice versa . . . It is guaranteed not to bend or give way in any manner.



R and L Turning Tool used as BALANCING TURNING TOOL

R and L Turning Tool used as CENTERING & FACING TOOL



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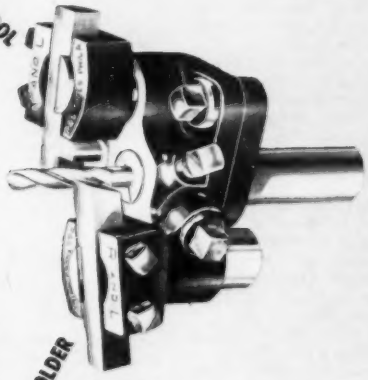
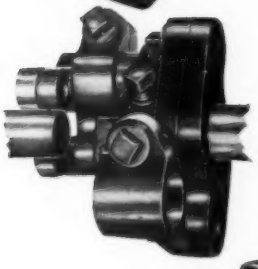


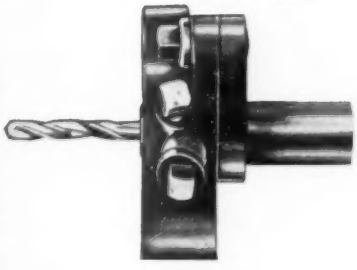
R and L Turning Tool used as BACK REST

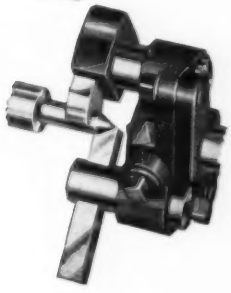


R and L Turning Tool used as ROLLER BOX TOOL

R and L Turning Tool used as FLOATING DRILL HOLDER

R and L Turning Tool used as POINTING TOOL





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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-251

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May 1958

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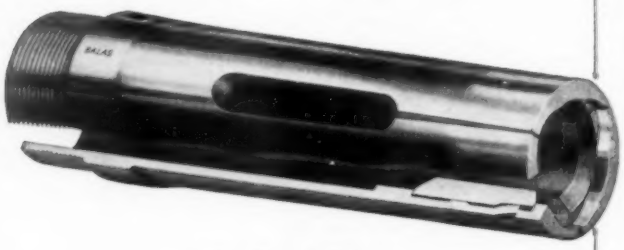
BALAS

FINGERS OF STEEL



with the Velvet Touch

YOU NEVER HELD IT SO GOOD!

MODEL "A" MASTER PUSHERS

Balas Model "A" Master Pushers have tension tailored to your specifications, light, medium or heavy depending on the type of stock you are using and the speed of your machines. The patented rocking ring provides a floating action on the part of the pad permitting it to follow the exact contour of the stock. This eliminates scratching and scuffing of the stock — reduces loss from scrap.

Pads of either steel, Meehanite, cast iron, bronze or carbide may be used and may be changed without removing the pusher from the tube.

For trouble-free feeding on simple or difficult jobs, you'll do better with Balas.

BALAS

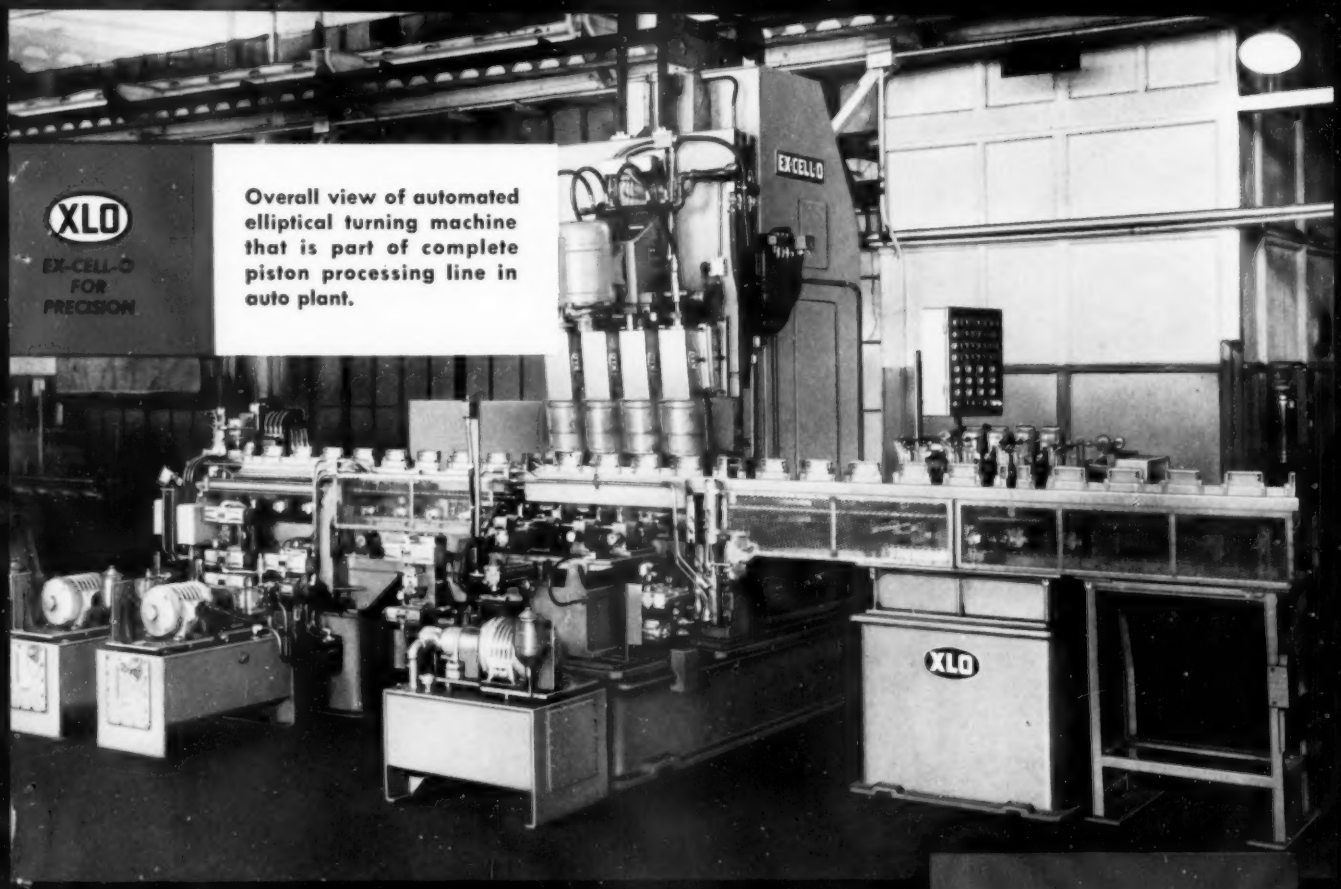
CARBIDE PUSHER PADS

Balas Solid Carbide Pusher pads treat your stock gently yet grip firmly. They are non-scratching, non-galling and unless you lose them they will probably last forever. Actual production tests prove that Balas Model "A" Master Pushers with Carbide Pads have turned out more perfect parts for longer periods than any other method. Try them and convince yourself.

Solid and Master Pushers as well as Solid and Master Collets in most popular sizes for most machines are available for immediate delivery from stock. Write for catalog and price list.

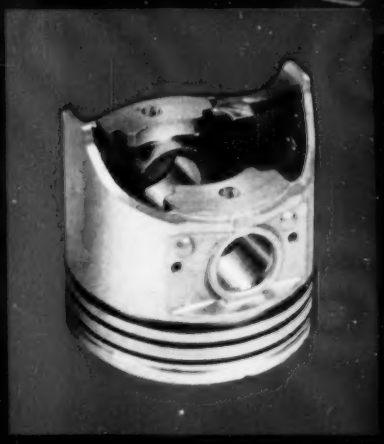
BALAS COLLET manufacturing co.

Cleveland, Ohio



Overall view of automated elliptical turning machine that is part of complete piston processing line in auto plant.

Roughs and Finishes 250 Pistons per Hour



57-77

This automated Ex-Cell-O machine semifinish and finish turns an elliptical shape on automotive piston skirts at the net rate of 250 pieces per hour.

Pistons enter the machine from a conveyor, are radially located from their wrist pin holes and clamped on the ring land diameters. Four heads machine four piston skirts simultaneously. Air gaging follows the machining operation, after which pistons are ejected to another conveyor.

Write to Ex-Cell-O or contact your local representative for further information or a proposal.

EX-CELL-O CORPORATION *Machinery Division*

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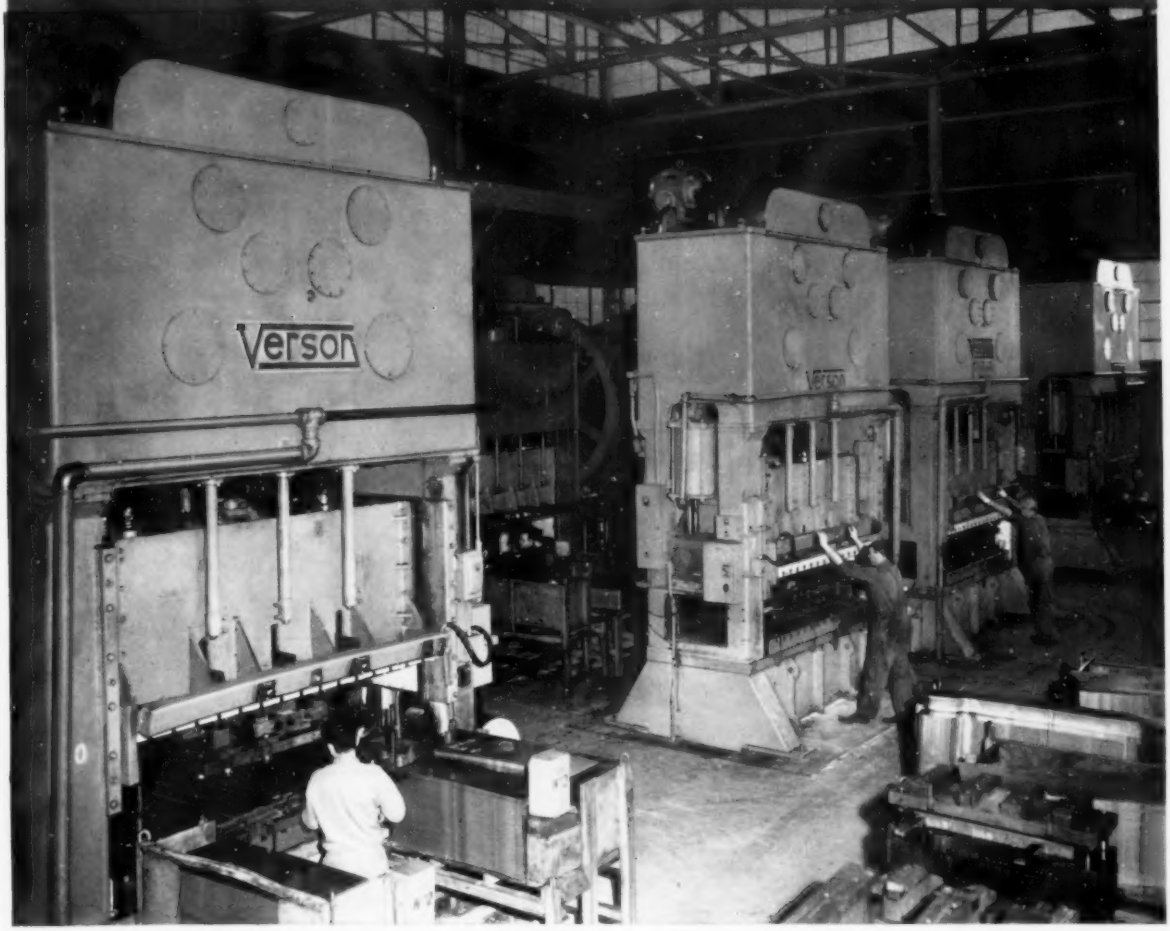

Another versatile production process engineered and developed by Verson

To achieve a more efficient, more flexible metal-working plant, Lobdell-Emery Mfg. Co., Alma, Michigan, recently installed these four Verson 250 ton eccentric presses.

Used as individual units, the machines are employed for blanking, drawing and forming operations on a variety of parts. In operation as a production process, the four units are utilized for the fabrication of station wagon panels. Primary production is on seat backs and cushions and floor panels for a major automotive manufacturer.

The four machines are identical. Each has a capacity of 250 tons with slide and bolster area measuring 48" x 96". Operating speed is 25 SPM.

If versatility of operation is one of your aims . . . and more profitable production essential, look into the Verson concept . . . "Anyone can build a press . . . Verson builds production processes."

182-C

A Verson Press for every job from 60 tons up.

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